

AMD RYZEN 3RD GEN WINS AGAIN

apoc

Oct 2019  
Issue 472

YOUR EXPERT

GUIDE TO TODAY'S TECH



**BUDGET &  
MID-RANGE  
CHAMPIONS**



**NVIDIA RTX  
2080 SUPER**

CUT-PRICE POWER GAMING  
HITS THE SWEET SPOT



**CUSTOMISE  
WINDOWS 10**

60 WAYS TO GIVE YOUR  
OS A MAKEOVER

**NO INTEL OR  
AMD INSIDE?**

QUALCOMM WANTS TO  
RUN YOUR PC

**LIVE IN THE FUTURE, TODAY.**  
**SMART HOME  
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**DIY PROJECTS**

**MONITOR YOUR  
NETWORK WITH  
A RASPBERRY PI**

**USING GOOGLE DRIVE  
& iCloud DRIVE**

**TESTED:  
ACER SWIFT 7**

PLUS, MSI GT76,  
DELL LATITUDE 5400,  
16TB SEAGATE IRONWOLF  
PRO, ACER X35 PREDATOR  
MONITOR



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# ULTIMATE

## X35 Monitor

3440 x 1440 UltraWide QHD

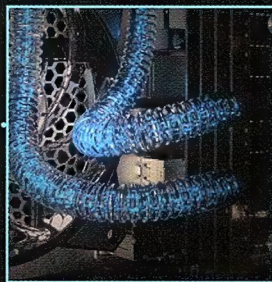
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4ms  
RESPONSE

200Hz  
OVERCLOCK

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SSD

1TB  
HDD



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NVIDIA SLI®

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CPU Liquid Cooler

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DDR4

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GeForce RTX™ 2080

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Max-Q Design

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with NVIDIA® G-SYNC®

4th Gen AeroBlade™ 3D  
Technology



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GeForce RTX™ 2080

4th Gen AeroBlade™ 3D Technology

**3ms2**  
RESPONSE

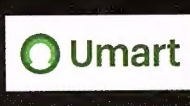
**144Hz**  
OVERCLOCK



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apc



# Hey Google

Make my lights red.



Yes, it is true that smartening your home is a slippery slope. From small things, big things grow, and teching-up your house is a lot of fun. It could start with just a single \$40 smart bulb that you

control from an app. How sweet it is to choose any of millions of colours and intensities. You'll laugh out loud the first time you try it in your home, as you realise the serious potential in that moment. I've become quite partial to war room red in my gaming room. It makes me feel like I'm stepping into the combat information centre in a warship.

So you get a couple more. Maybe a few more. But now your smartphone isn't so great for controlling so many smart bulbs. Sure, it's still exciting and fun, but all that tapping is slowly becoming a chore. A smart speaker comes next, because alongside the joy of simply asking for any song you might suddenly desire, the speaker becomes your access point for everything else. Such as the aforementioned smart bulbs, which turn from warm red to sunset yellow whenever I command.

You may want to smartify other non-smart things. My decade-old

radiator heater is definitely not smart, but it is now that I've plugged it into a D-Link Wi-Fi smart plug. With that I graduated to next-level IFTTT integration, because I'm now too lazy to remotely turn the heater on by tapping an app icon when I'm on the way home, so now it knows when I'm within 1km of the house by tracking my smartphone's location and preparing the house for me as I approach.

It's lovely stuff and a whole lot of fun to get up and running and mess around with. Best of all you can dip just a toe in Lake Smart to get started and then gradually immerse yourself more as you get the taste of how much it can make home life cooler. It's so enjoyably satisfying that, soon, you'll delve even deeper into how much more smart gear can do. It becomes a hobby that brings actual benefits to the home and all of its occupants.

In this issue of APC we've put together a few ideas to help you get going. Maybe you've already taken your first steps, or, perhaps have dived in a little more deeply and are looking for fresh inspiration. It's all here. See you next month!

**BEN MANSILL**  
EDITOR  
ben.mansill@futurenet.com

Future Publishing Australia, PO Box 1077 Mount Street,  
North Sydney, NSW 2059  
Subscription enquiries: Please call CRM: (02) 8227 6486  
Tel: (02) 9955 2677 Fax: (02) 9955 2688  
Email: apcmag@futurenet.com  
Web: www.apcmag.com

#### Editorial

Editor: Ben Mansill  
Senior Journalist: Shaun Prescott  
Journalist: Joel Burgess  
Journalist: Harry Domanski  
Journalist: Stephen Lambrechts  
Journalist: Sharmishta Sarkar  
Creative Director: Troy Coleman  
Designer: Sharnae Swinnerton

#### Contributors

Jonni Bidwell, Christian Cowley, Drian Cutress, Rich Edmonds, Dan Gardiner, Christian Guyton, Lindsay Handmer, Matt Hanson, Malindy Hetfield, Kenny Hemphill, Phil Iwaniuk, Andy Kelly, Stephen Lambrechts, John McCann, Howard Oakley, James O'Connor, Steve Paris, Nick Peers, Mayank Sharma, Shashank Sharma, Alan Stonebridge, Tom Sykes, Mark Wycislik-Wilson.

#### Photography

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#### Advertising

Group Advertising Manager: Cameron Ferris  
cameron.ferris@futurenet.com

#### Management

Managing Director: Neville Daniels  
Sales Director: Paul Marttila

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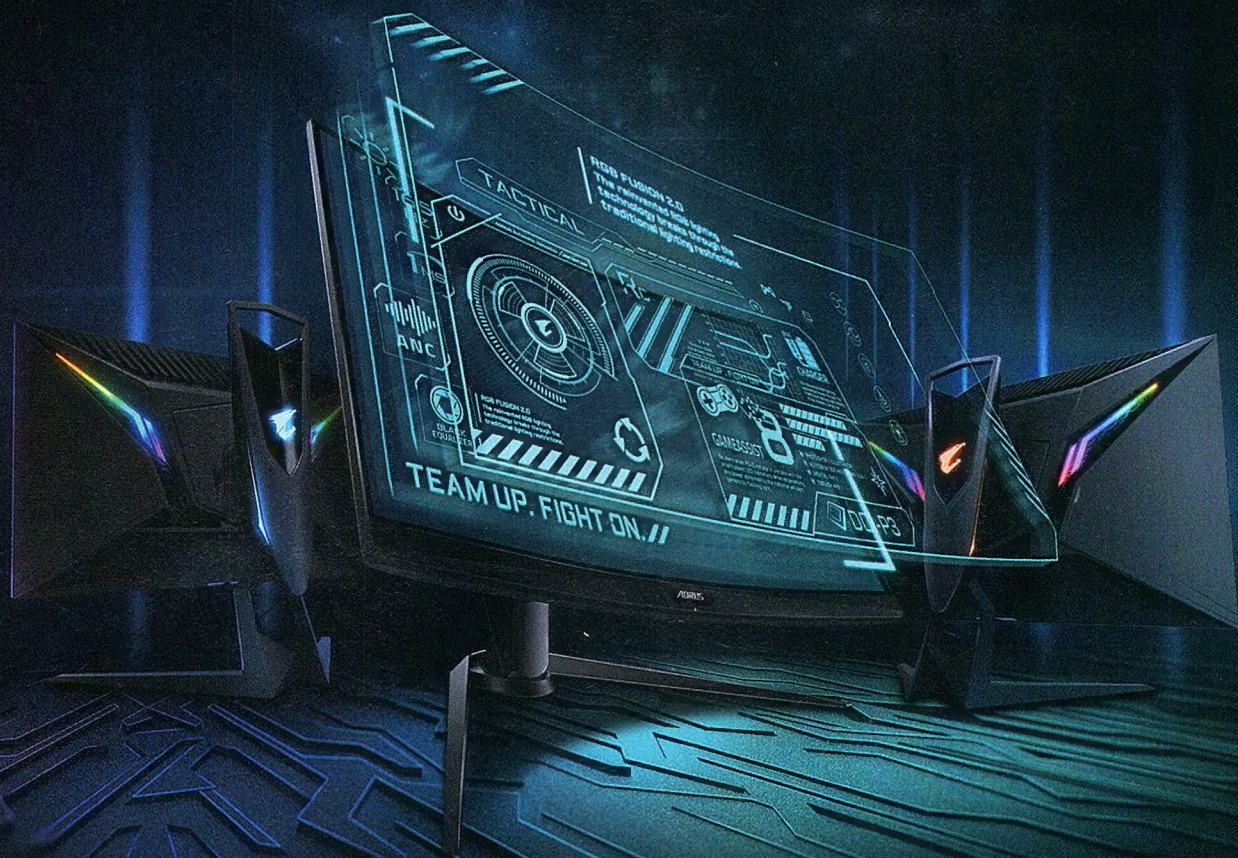


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MMORPG GAME



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Recommended for IMMERSIVE  
ENTERTAINMENT



**AORUS KD25F** [Flat Monitor]

Recommended for FPS GAME



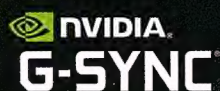
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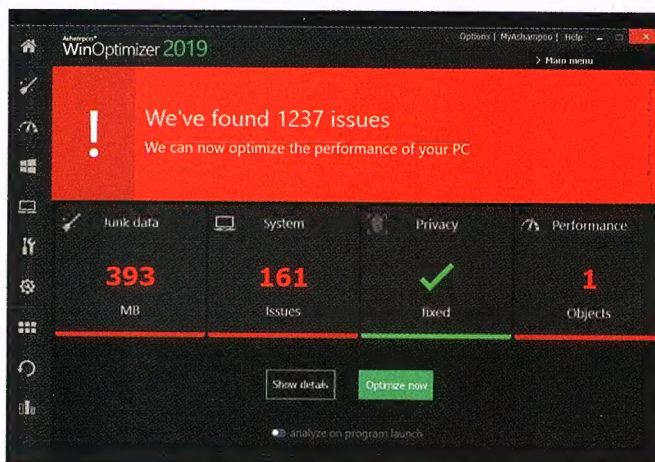
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# SMART HOME

# STARTER KIT

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**QUALCOMM AND THE RISE OF NON-X86 WINDOWS**  
Will your next PC have neither Intel or AMD inside?

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"It looks like the way we use those devices could change forever, and Intel needs to adapt – or die."  
Qualcomm non-x86, page 70



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## Acer Predator X35

Is this the holy grail of gaming monitors, or just a sacrilegiously expensive one?

Ticking off just about every monitor spec a modern PC gamer could dream of, this 35-inch LED-backlit VA screen from Acer has been a long time coming. First revealed back in August 2017, the X35 has taken nearly two years to come to market, and it's joined by near-identical competitors from Asus and AOC, with all three employing the same ultrawide panel from AU Optonica (AUO).

We've seen similar 35-inch, 21:9 gaming screens before, with an earlier generation of AUO screens from 2017 still widely available, offering more sedate specs (a 100Hz max refresh rate with FreeSync) at a still-pricy \$1,000 to \$1,500 in Australia.

At an eye-watering \$3,999, this Acer model is in another league entirely, putting it out of reach of all but the most well-heeled of gamers. But that said, there's nothing that even comes close when it comes to specs: that curved panel provides a 200Hz refresh rate alongside

G-Sync DisplayHDR 1000 support, full-array local dimming (FALD) backlights and a designer-friendly 90% DCI-P3 colour gamut. Its 3,440 x 1,440 pixel resolution doesn't need an array of top-shelf cards to drive it... well, not unless you want to hit 200 frames per second to match that refresh rate.

Out of the box, its colour accuracy is excellent too – we ran it through an X-Rite i1Display Pro calibration, and found it matched Adobe RGB/USWB settings without any tweaking required, and its colour uniformity was also outstanding, with exceptional backlight evenness and no indications of light bleed around the edges – so it's immediately ready to go for basic colour-accurate design work.

This really is a monitor that's intended for entertainment, though, and there it doesn't disappoint either. In games that support high dynamic range colours (such as Metro Exodus and Shadow of the Tomb Raider) that DisplayHDR 1000 spec

doesn't feel like a narrow viewpoint.

There's one glaring fault with the X35, however, and that's ghosting. VA panels have been a bit notorious for this in the past, and the problem's particularly noticeable when you have a dark black element against a lighter background, with that high-contrast visual causing dark trails to lag along behind the black area when it's in motion.

As much as we love the other aspects of this display, however, for this kind of price we'd be expecting perfection – and unless you never play games with these kind of high-contrast visuals, we'd have trouble recommending this otherwise stonking screen.

Dan Gardner

**Verdict**  
Amazing specs and mind-boggling performance are somewhat offset by the odd (but pesky) ghosting.

★★★★★

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**DrayTek Vigor2133Vac**

**Seagate 16TB Ironwolf & Ironwolf Pro HDDs**

**Alcatel 3 (2019)**

**Verdict**  
Amazing specs and mind-boggling performance are somewhat offset by the odd (but pesky) ghosting.

★★★★★

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## Inside APC

Find out all about APC's editorial policies, test practices, how to read the benchmark results, and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech, too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And, like you, APC's journalists want to know what's good in tech – no matter what platform it resides on.

### INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men and -women, however, and APC aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in APC are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an APC reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

### LABS TESTING

Despite being a small magazine with limited resources, APC still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

In most cases, for the benchmark results published in APC, you can assume that higher is better. There are certain tests that deviate from this rule where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.



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## How to spot an Athena PC NEW LAPTOP STANDARD FROM INTEL NOW HAS A LOGO.

Intel's Project Athena notebook standard, which we wrote about in our Computex report in APC 471, now has a visual identifier and imminent release of actual hardware. Athena-compatible laptops must have system wake in under a second, use i5 or i7 CPUs in addition to Optane, offer at least 16 hours of battery life, have Wi-Fi 6 and Thunderbolt 3. The new Dell XPS 13 2-in-1 will be the first Athena machine.



## Huawei's HarmonyOS is official

READY TO TAKE ON ANDROID, IF  
NECESSARY.

HarmonyOS, Huawei's new cross-device operating system, has been announced by its CEO, Richard Yu at HDC 2019, the company's Developer Conference in Dongguan, China. Clearly a thinly-veiled response to political events over the last year, the message is clear – if Huawei needs to ditch Android down the line, it can. He clarified that the switch would be "quick and easy", putting forward fighting words while clearly safeguarding his company's partnership with Google.

## First details of Intel Ice Lake products

A CPU FRENZY AS BOTH PLAYERS UP THE GAME.

Intel has lifted the lid on the processors for both its Ice Lake-U and Ice Lake-Y mobile processors. These processors are now being produced in sufficient volume to supply key launch partners with hardware in order to enable laptop and mobile designs to hit the shelves by the end of the year. Intel is not currently discussing any desktop or server processor equivalents at this time: the base Ice Lake design is currently a quad-core processor with HyperThreading, and beefy integrated graphics.

Intel's Ice Lake platform is the company's second attempt at producing a 10nm chip for the mass market, and follows on from the Cannon Lake platform. Using 'the same but different' 10nm process, Ice Lake features a new 10th Gen Core microarchitecture called Sunny Cove, Gen11 graphics, and support for LPDDR4X-3733 as well as Thunderbolt and Wi-Fi 6. Read more about the new series in Tech Brief on page 16.

On the server front, Intel launched the 14nm Xeon Platinum 9200-series CPUs with up to 56-cores, while AMD's new 7nm Epyc Rome series with up to 64 cores was also launched.

### INTEL ICE LAKE SPECIFICATIONS

|          | PROCESSOR      | CORES/<br>THREADS | GRAPHICS<br>EUS | CACHE | NOMINAL<br>TDP/ CON-<br>FIGUP TDP | BASE<br>FREQ | MAX SINGLE<br>CORE TURBO<br>(GHZ) | MAX ALL<br>CORE TURBO<br>(GHZ) |
|----------|----------------|-------------------|-----------------|-------|-----------------------------------|--------------|-----------------------------------|--------------------------------|
| U-SERIES | CORE I7-1068G7 | 4/8               | 64              | 8MB   | 28W                               | 2.3          | 4.1                               | 3.6                            |
|          | CORE I7-1065G7 | 4/8               | 64              | 8MB   | 15W/25W                           | 1.3          | 3.9                               | 3.5                            |
|          | CORE I5-1035G7 | 4/8               | 64              | 6MB   | 15W/25W                           | 1.2          | 3.7                               | 3.3                            |
|          | CORE I5-1035G4 | 4/8               | 48              | 6MB   | 15W/25W                           | 1.1          | 3.7                               | 3.3                            |
|          | CORE I5-1035G1 | 4/8               | 32              | 6MB   | 15W/25W                           | 1            | 3.6                               | 3.3                            |
|          | CORE I3-1005G1 | 2/4               | 32              | 4MB   | 15W                               | 1.2          | 3.4                               | 3.4                            |
| Y-SERIES | CORE I7-1060G7 | 4/8               | 64              | 8MB   | 9W/12W                            | 1            | 3.8                               | 3.4                            |
|          | CORE I5-1030G7 | 4/8               | 64              | 6MB   | 9W/12W                            | 0.8          | 3.5                               | 3.2                            |
|          | CORE I5-1030G4 | 4/8               | 48              | 6MB   | 9W/12W                            | 0.7          | 3.5                               | 3.2                            |
|          | CORE I3-1000G4 | 2/4               | 48              | 4MB   | 9W                                | 1.1          | 3.2                               | 3.2                            |
|          | CORE I3-1000G1 | 2/4               | 32              | 4MB   | 9W                                | 1.1          | 3.2                               | 3.2                            |

## 8chan dropped by Cloudflare following US shootings

CLOUDFLARE WILL NO LONGER PROVIDE SECURITY SERVICES  
TO 8CHAN.

Web services company Cloudflare announced that it will no longer provide security protection to the imageboard site 8chan following the recent mass shooting in El Paso, Texas. 8chan is at the center of the discussion due to the alleged shooter posting his 2,300 word 'manifesto' on the site 19 minutes before the shooting began. Cloudflare had previously cited free speech issues as the reason it had not pulled its services from extremist websites, though the company did end support for the white extremist site the Daily Stormer in the past. In a blog post announcing that it would terminate 8chan's service, Cloudflare CEO Matthew Prince explained the hosting service's reasoning: "The rationale is simple: they have proven themselves to be lawless and that lawlessness has caused multiple tragic deaths. Even if 8chan may not have violated the letter of the law in refusing to moderate their hate-filled community, they have created an environment that revels in violating its spirit." At the time of writing, the owner of 8chan had been subpoenaed to appear before a US court.





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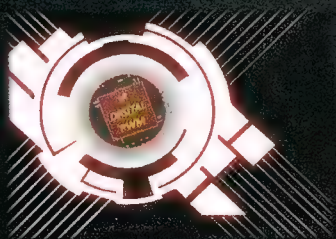
# RYZEN AMD



THE NEW X570 MOTHERBOARD

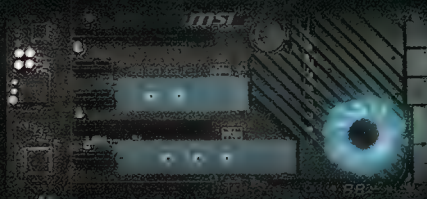
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## CORE BOOST

MSI X570 whole series motherboards adopt high-end IR digital power design which provide faster and undistorted current delivery to the CPU at pin-point precision. Core Boost not only supports multi-core CPUs but also creates the perfect conditions for your CPU overclocking.



## FROZR HEATSINK DESIGN

Designed with the patented fan and double ball bearings, Frozr Heatsink Design is not only to maintain the best performance for enthusiast gamers and prosumers, but also to provide the extra airflow for your M.2 SSD.

**LIGHTNING GEN 4**



## LIGHTNING GEN 4 SOLUTION

Combining 3rd Gen Ryzen processors, MSI X570 motherboards feature latest Lightning Gen 4 solution on both PCI-E and M.2 slot. FOR MEG series motherboards, you can even find triple Lightning Gen 4 M.2 slot with up to 64Gb/s speed.

See the all-new range at [au.msi.com](http://au.msi.com)





## Intel's deep learning accelerator

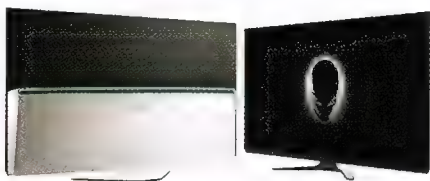
**MORE DETAILS REVEALED ABOUT THE 27-BILLION TRANSISTOR MONSTER.**

Intel revealed fine-grained details about its much-anticipated Spring Crest Deep Learning Accelerators at Hot Chips 31. The Nervana Neural Network Processor for Training (NNP-T) comes with 24 processing cores and a new take on data movement that's powered by 32GB of HBM2 memory. The spacious 27 billion transistors are spread across a 688mm<sup>2</sup> die. Oddly enough, the NNP-T also incorporates leading-edge technology from Intel-rival TSMC.

## Firmware security has barely improved over last decade

**IT MIGHT HAVE ACTUALLY GOTTEN WORSE.**

A new survey carried out by the Cyber Independent Testing Lab (CITL) looking at over 6,000 firmware images has found no improvement in firmware security over the last 15 years. CITL found that firmware from commonly used manufacturers such as Linksys and Netgear failed to implement basic security features, such as non-executable stacks and stack guards, even in the most recent versions of the firmware.



## Alienware has made a 55-inch OLED gaming TV

**BUT WOULD YOU DROP US\$4,000?**

While we've seen some big format gaming monitors before, Alienware has come up with one that features some truly impressive specs for its size. Typically, you'd have to compromise either size, panel type, or refresh rate, but this beast is a whopping 55 inches and has an OLED display with an impressive 120Hz refresh rate and AMD FreeSync support. No word on local availability, but US\$4,000 translates to some serious Australian dollars.



## World's largest computer chip on the way

**22CM ACROSS WITH 400,000 CORES.**

The CPUs and GPUs (and other chips) we use are cut from a large wafer that produces hundreds or even thousands of individual chips, but Californian company Cerebras Systems has managed to create a single processor from an entire wafer. Measuring 22cm on each side, the Wafer-Scale Engine is intended for use in Artificial Intelligence applications.

Producing a single chip from a single wafer has long been a Holy Grail of the computer industry, but it was thought this was still many years away. Cerebras' product is built this way to substantially reduce the latency incurred when data is travelling between cores in a more orthodox design. According to the company, neural networks work best when thousands of operations are executed at the exact same time, with data being shared in parallel across the chip without any delays.

The 1.2 trillion transistor device gets around small defects inherent in any wafer by incorporating redundant circuits that take on the tasks of non-functioning areas of the device. Cerebras worked with TSMC and the device is now shipping to developers.

## IBM researchers unveil new remote hacking method dubbed 'warshipping'

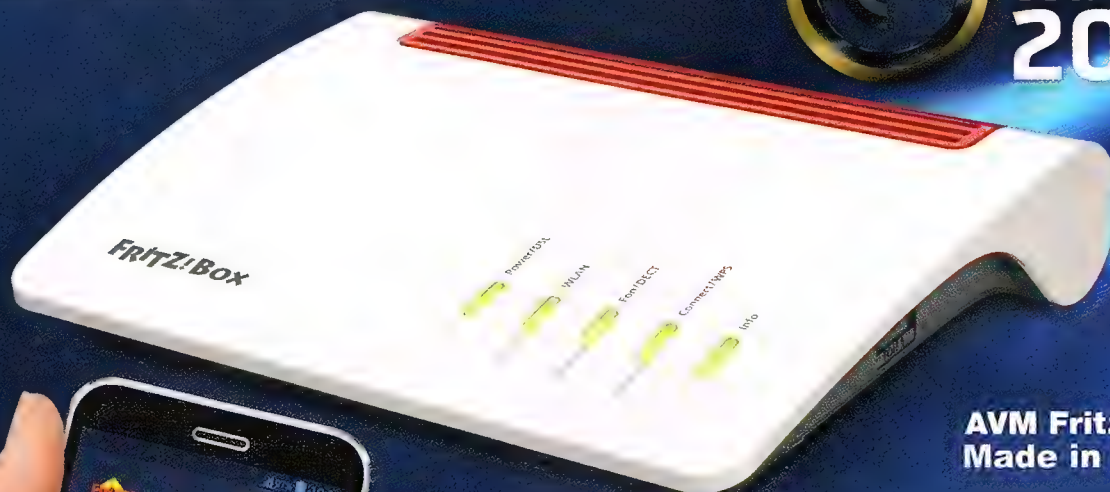
**USING PARCEL POST AND SOME CLEVER PARTS.**

Researchers from IBM's offensive security team, X-Force Red, have recently shown off a new hacking technique at an annual cybersecurity conference in Las Vegas. It works from a similar premise to the existing 'wardriving' exploits where hackers would cruise around in vehicles, searching for vulnerable Wi-Fi networks in order to gain local access. However, a remote hacking device constructed from low-cost, low-energy components is instead inserted into a regular package and simply mailed to the target's location – be it a company or CEO's house, for example – from which point it can likely remain within range of the victim's Wi-Fi network for hours, if not days, before being discovered. The form of attack has been dubbed "warshipping" (presumably because 'Trojan horse' is already taken) and has been apparently shown off in order to "educate customers about security blind spots and modern ways that adversaries can disrupt their business operations or steal sensitive data", according to X-Force Red. The device presented at the Las Vegas conference cost the team less than US\$100 to construct and included a 3G modem on a single-board computer with a Wi-Fi chip. ■



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 DESIGN  
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**AVM Fritz!Box 7590  
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 enjoy full mesh networking**



**Connected in no time  
 with WPS (Wi-Fi Protect-  
 ed Setup)**



## 10th gen Intel Core processors

Intel's next generation of CPUs is now official and headed to a slew of new laptops and mobile devices. Here's everything you need to know.

**A**fter months of teasing their arrival, Intel has finally unleashed its 10th Gen Core processors on the world. This generation, Intel has made the leap to a new architecture and manufacturing process, bringing the usual performance and battery life improvements you'd expect from a generational leap. But there are also some extra features tagging along for AI and graphically intense workloads.

For now, the 10th Gen Intel Core chips are only available for laptops, but this is just the start. Whether you're looking to pick up a new laptop, or waiting to get your hands on a desktop part, here's everything you need to know.

### WHAT'S NEW

Intel's 10th Gen Core processors represent a more significant update to the company's lineup than recent generations. That's because Intel has made the move to a 10 nanometer (nm) process, a significant change from the 14nm process Intel has been using since 2014. A smaller process means the CPUs using it are more power efficient, reducing their power consumption requirements and, subsequently, increasing battery life.

However, apart from the shift to 10nm, Intel has done some significant work on improving the feature set for its 10th Gen Core chips. Notably, Thunderbolt 3 support is now built into these new CPUs, meaning it will be much easier for PC manufacturers to include it in

laptops. These new chips also support Wi-Fi 6 (802.11ax), the latest Wi-Fi standard that is only now starting to hit the market and is built for faster transfer speeds and the ability to better handle lots of connected devices.

### HOW MANY 10TH GEN CPUs ARE THERE?

Currently, there are 11 10th Gen Core processors available, all of which are built for laptops and 2-in-1s. Those 11 chips break down to five low-power Y-series and six higher performance U-series options, each spread across a variety of Core i3, i5, and i7 CPUs. See the table in our news page 12.

### WHAT DO THE MODEL NUMBERS MEAN?

Intel model numbers can be hard to follow, and the 10th Gen Core naming scheme has confused matters more. The basics remain the same: Intel Core represents the brand, and the different i3, i5, and i7 designations relate to the "brand modifier," as Intel calls it. Put simply, the higher the number in the modifier, the more powerful the processor. Moving further, we get a

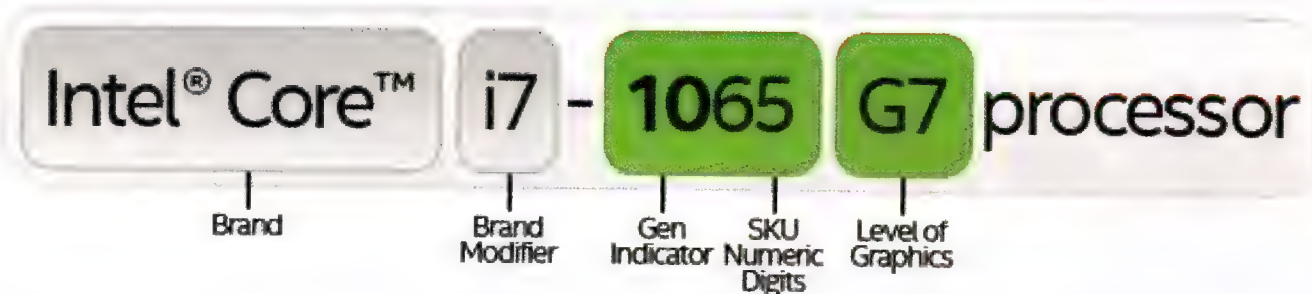
generation indicator (10 in this case), two digits for the stock-keeping unit (SKU), and then a number indicating the level of graphics included with the chip.

So, looking at the Core i7-1068G7 as an example, we can see that it's a Core brand and i7 brand modifier. From there, the 10 means that this is a 10th Gen chip, while the 68 indicates the SKU number. Finally, the G7 denotes the graphics level of this chip, which happens to be the highest available at the moment.

### WHEN ARE 10TH GEN DESKTOP CPUs COMING?

There's no precise release date for Intel's 10th Gen Core chips for desktop PCs. However, Intel has stated it expects to release 10th Gen Core processors for other PC segments throughout the next 12 months. Expect to hear more about Intel's desktop plans, including a list of models and their specs, in the coming months. ■

**"Thunderbolt 3 support is now built into these new CPUs, meaning it will be much easier for PC manufacturers to include it in laptops."**







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# gadgets

» JOEL BURGESS GATHERS THE GOOD GEAR

## KEYSTONE

Switch to a more advanced keyboard design.

US\$179 | [INPUT.CLUB](#)

The Input Club is a startup hoping to change the current status quo in keyboard design with a new magnetic silo switch that uses old keyboard technology to make a more advanced keyboard. Each key in the silo switch will contain a magnet that induces a current in nearby conductive metals when moved. This mechanism means that instead of having one single on/off actuation point like current switches, the magnetic silo switch can detect both the rate and depth of any keypress. When combined with AI software on the company's Keystone keyboard Kickstarter, this additional information gives each key additional functionality like single key capitalisation.



## ROG PHONE II

The ROG Phone is making a comeback.

\$TBC | [ASUS.COM/PHONE/ROG-PHONE/](#)

While it might look like a regular 6.59-inch smartphone from the front, on the flip side, Asus's ROG Phone II looks like a gaming laptop with its metallic air vent and holographic decals. The ROG Phone II is running a Qualcomm Snapdragon 855+ (a souped up version of the octa-core chip in Samsung's Galaxy S10 range), 12GB of RAM and a 15% faster than average Adreno 640 GPU. This high-performing CPU powers a 120Hz FullHD HDR AMOLED display and has been fitted with generous heat sinks to allow you to game longer. There's even an active cooling attachment for those who 'need' it.

## JAYBIRD VISTA

Hasta la Vista earbud dropouts.

\$299.95 | [WWW.JAYBIRDSPORT.COM](#)

Jaybird has a new range of lightweight true-wireless sport headphones that the company are saying are its most compact and durable to date. Weighing in at just 6g apiece and occupying a maximum width of 24mm, the Vista earbuds are kept in place by your choice of variously sized wingtip 'eargels' that seal the ear canal for the best audio quality. The waterproofing has also been upped from Jaybird's earlier true-wireless headphones to IPX7 water and sweat resistance. What's perhaps most improved however, is the overall connection stability and the button interface that controls playback. Both of these integral features have been improved significantly from Jaybird's earlier true wireless models.







### **GALAXY WATCH ACTIVE 2**

The bezel is back on Samsung's fitness focused smartwatch.

FROM US\$279 | [SHOP.SAMSUNG.COM](https://shop.samsung.com)

The original Galaxy Watch Active took a gamble by ditching the bezel that was emblematic of its predecessors, but this omission seems to have been reinstated on the Galaxy Watch Active 2. With less than six months between device iterations we're not surprised that the rotating bezel is a digital interface rather than a tactile physical ring. The Galaxy Watch Active 2 offers LTE and Wi-Fi variants and will come in either 40mm or 44mm sizes. Other than this, the biggest update is a 7% and 47.8% battery capacity bump in the new 40mm and 44mm Galaxy Watch Active 2 smartwatches, respectively.

### **VOAMOKO USB-C NUMERIC KEYPAD**

This keyboard attachment is playing the numbers game.

US\$56 | [VOAMOKO.COM](https://voamoko.com)

While Apple has a lot of shortcuts that help creatives, anyone who works with numbers will resent the MacBook Pro and Air for omitting the number pad. Voamoko however, is here for all those number crunchers with a new USB-C number pad that you can attach to your device via USB-C or Bluetooth. While the wireless option will often seem like the best solution, the device also includes two USB Type-A sockets that can be used to connect to the computer through the device's USB-C cable. This compact 138g keyboard offers 50 hours of working battery life and a two month standby time.



### **BREWART BEERDROID**

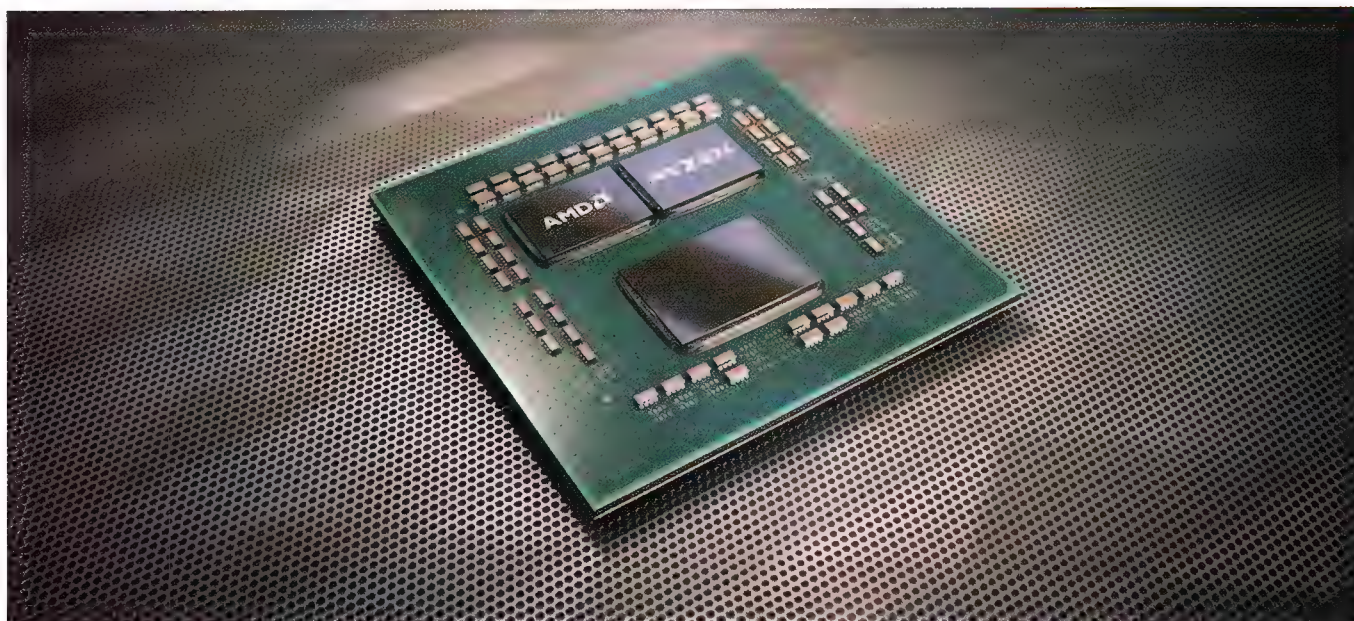
Coopers' automated fermenter takes the guesswork out of homebrewing.

\$799 | [WWW.BREWART.COM](https://www.brewart.com)



If you've ever dreamt of brewing your own beer but never quite pulled the trigger then the BeerDroid from Brewart may be the package you've been waiting for. Imagine this as the Nespresso of homebrew beer, where you order the packaged extract and hop concentrate online, add its contents to the BeerDroid, mix in a bit of water and wait for your DIY brewski to come to fruition. With automatic temperature controls and brewing schedules the BeerDroid takes all the risk out of fermenting at ambient temperatures and since the recipes have been developed by the brewers at Coopers, they should be bang on for taste. ■





## Is there a problem with 3rd Gen Ryzen idle voltage and temperatures?

TL;DR: No there is not.

**W**henver a new processor family is released, enthusiasts, overclockers and early adopters share their experiences all across the internet. Sometimes, expectations and pre conceptions override facts, and we have a classic case of this occurring following the release of AMD's 3rd generation Ryzen series. The issue relates to what on face value appears to be higher than expected idle voltages and temperatures.

Some users rightly expressed concern that their CPUs were reaching as high as 1.5v, leading to spikes in temperature. At face value this is ridiculously high for a 7nm processor, but actually this is perfectly normal behaviour and is exactly the way AMD designed it.

Matisse processors are designed to react very quickly to changes in load. The processor responds to what it thinks requires a boost state and applies a short term (milliseconds) voltage boost to achieve this. Of course this also means there can be a corresponding very short duration

spike in temperature. The problem is that monitoring software generally doesn't understand this behaviour. A lot of monitoring tools poll the processor many times every second. Combine this with other commonly used apps like motherboard or peripheral manufacturer's software suites (which also include monitoring tools) and other background apps and we have the processor thinking it needs to enter its maximum boost states for a sustained load. It's a classic case of the observer effect.

Your CPU isn't pumping 1.5v though itself for any true length of time. It's a transient voltage that's being misinterpreted by almost all of the monitoring tools. A spike in temperature is generally isolated to one of the many temperature sensors, which is very brief and unrepresentative of the true temperature of the CPU.

In response to this 'issue', AMD has released a new chipset driver. This increases the clock selection interval to 15ms which aims to filter out all of those undesirable boost requests. This should relax the processor when it's

under intermittent load without affecting the ability of the processor to react to sustained workloads that require boost clocks and voltages. It also implements a new balanced power plan in Windows.

AMD isn't blameless here. All of this could have been avoided if AMD had communicated with software developers prior to the launch so that their tools took the new processors' behaviour into account. Surely they'll learn from this so we don't see an unnecessary repeat of it. You can expect monitoring tools to be updated so they read the averages of the various temperature sensors, and hence better reflect the true temperatures of the whole package, and not just a fleeting isolated part of it.

At the end of the day, AMD knows what it's doing. Engineers ran systems day after day for many months before the release. They know more about their processors than the average forum guy. Your stock CPU is doing exactly what it was designed to do. Having said that, if you're messing about with PBO and overclocking, that's a different story... ■



## Facebook is slowly rolling out new privacy tools – but can they make a difference?

There's not really any turning back for long term social media users, Shaun Prescott writes.

Plenty of Facebook users are newly privacy conscious thanks to the 2017 Cambridge Analytica debacle, and yet, many remain unaware of just how closely the social media platform tracks them. With the announcement of a new Facebook feature which allows users to "clear" their "Off-Facebook Activity", it's now possible to see just how far-reaching the site's tentacles extend.

The new feature, which rolled out in select territories in August (sadly, Australia isn't one of them), allows users to see a list of all the sites that send their behavior data to Facebook. Often this tracking is something we opt-in to without knowing the ramifications: if you've ever used your Facebook account to create a new account on any website, that website will appear in the list.

But that's not the only way third-party sites secure your data via Facebook. If they've embedded a "like" button on their site and you've clicked it, they have access to related data. Likewise with comments. Most notoriously, many sites install a Facebook pixel – an invisible page module which signals to Facebook that you've visited that site. These can appear anywhere from major news sites, such as *The Guardian* and *Buzzfeed News*, through to quite possibly porn sites. So yes, if you've visited a porn site, Facebook might know about it: a study reported by *The New York Times* found over 22,000 pornography sites were "riddled" with trackers associated with major tech companies.

Once you've accessed this list on Facebook (and it's secreted within

menus – Facebook won't be sending you a notification once it's available), you'll have the option to untether these off-Facebook sites either individually or across the board. So for example, you can disconnect Spotify, but that means you'll no longer be able to use your Facebook account to access your Spotify account.

It's a step in the right direction, though it's a far cry from the 'Clear History' tool Mark Zuckerberg framed it as last year. While it will sever the connection between Facebook and the sites you collect, it won't "clear" the data those sites already have associated with you. Nor will it remove the associated data hosted by Facebook, though it will be made anonymous, ie, your fingerprints won't remain on it.

The functionality has only been rolled out in Ireland, South Korea, and

Spain so far, with no timeline for other regions. Anyway, given how central behavioral data and advertising is (whether onsite, or for Facebook's clients), it's definitely wiser to stop using Facebook entirely if you have privacy concerns, or just don't sit well with the idea of having your internet usage recorded for profit.

In an interview with *Buzzfeed News* last year, former Federal Trade Commission chief technologist Ashkan Soltani echoed many former Facebook employees when he insinuated that the company has no interest in bolstering privacy for the moral or ethical sake of it. "My worry is that Facebook is doing anything it can to garner goodwill and diffuse concern," he said. "I'm not sure of the sincerity of those actions since, historically, the company uses privacy selectively and strategically." ■



### END USER

### Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at [apcmag@futurenet.com](mailto:apcmag@futurenet.com). All correspondence becomes the property of APC and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.



## 5G: the future or a dangerous intergovernmental conspiracy?

The internet says 5G is bad for you, but is it really? Joel Burgess writes.

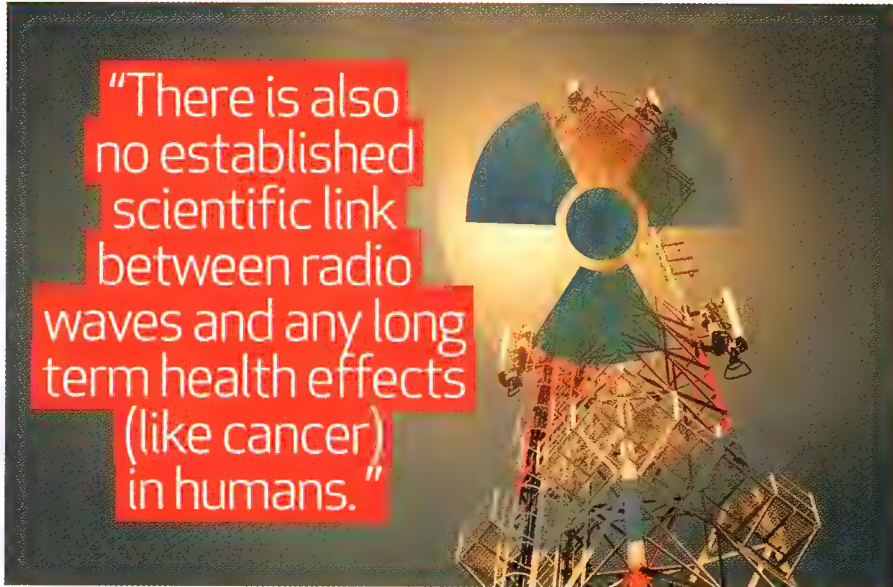
Many new technologies generally offer the promise of a more convenient lifestyle; but when the science behind them isn't readily available, or it's intentionally convoluted, new technologies can quickly feel like a frightening and potentially harmful leap of faith.

Recently we've seen a pushback highlighting the alleged dangers of the new 5G telecom network on community Facebook group message boards and in Google search results. From what we can garner, the argument is that 5G reduces the wavelength of radio waves, which could be more harmful to human health. Additionally, there are concerns that because 5G transfers information faster than previous technologies it increases the intensity of radio waves and, therefore, its potential to be harmful. What is interesting about these concerns, and what makes them surprisingly convincing, is that the initial premise is grounded, at least in part, in actual science.

While the initial 5G telecom rollout will use frequencies identical to what was available under 4G (i.e. 600MHz to 6GHz bands) there is a plan to extend this range to include what is called millimetre waves in the next two-to-three years in Australia. Millimetre waves are still classified as radio waves, but they are notably higher frequencies than traditional telecom bands ranging from 30GHz to 300GHz.

When you change the frequency of electromagnetic radiation you change its propagation properties and so millimeter waves do not travel as far as frequencies used in former telecom generations and need line-of-sight access to the device in order to transmit. This reduction in range means the network requires far more cell towers than previous technologies to get the same coverage, a fact that has likely sparked a broader interest in the community.

According to the Assistant Director of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA),



"There is also no established scientific link between radio waves and any long term health effects (like cancer) in humans."

Dr Ken Karipidis, there are no established health effects from radio waves (including millimetre waves) at the power levels used for telecommunications. This isn't just no negative health impacts, it means there is no scientifically detectable effect whatsoever on physiology at these power levels. Even if you include the study of radio waves at high power levels like those found in your microwave oven (which uses 2.4GHz radio waves to cook food), the only proven scientific effect on organic tissue is heat.

There is also no established scientific link between radio waves and any long term health effects (like cancer) in humans, according to Dr Karipidis, despite a large number of scientific studies in the area.

Dr Sara Loughran, the Director of the Australian Centre for Electromagnetic Bioeffects Research at the University of Wollongong and one of Australia's leading experts on the medical effects of radio waves suggested to APC that millimeter waves are, arguably, even less dangerous since they are incapable of penetrating the body past skin-level.

Earlier telecom generations actually used higher power, lower frequency waves that penetrate deeper into the body and can be absorbed by vital organs.

To put it in perspective, ARPANSA did a study measuring different radio frequency (RF) exposure levels in 20 school playgrounds around Australia and found that mobile phone base stations were responsible for ambient RF levels 500,000 times below the accepted Australian Standard while AM radio broadcast was 50,000 times below. The Australian standard for RF exposure is set at 50 times below the exposure levels where heat can be detected in cells.

Despite what some claim, millimeter waves are currently used in airport screening, police radar and remote sensing, and there has been no observed long-term health effects to date.

There are plenty of things in the urban environment that could significantly impact you and your family's health, but 5G communication transmissions, as far as we know, are not one of them. ■



# numbercrunch

» WE LOOK AT THE NUMBERS DRIVING THE BIG TECH NEWS.



# 22<sup>ND</sup>

THE WORLD RANKING OF NVIDIA'S NEW SUPERCOMPUTER, THE DGX SUPERPOD, WHICH IS TRAINING AI TO DRIVE CARS.



## 725 KMS

THE RANGE OF LIGHTYEAR ONE, A PROTOTYPE ELECTRIC VEHICLE COVERED IN SOLAR PANELS THAT WILL TOP THIS UP AT A RATE OF 12 KILOMETRES PER HOUR.



## 4

TIMES MORE POWERFUL THAN THE CURRENT XBOX ONE X IS THE CLAIM FOR MICROSOFT'S PROJECT SCARLETT, ITS NEXT-GEN XBOX CONSOLE.



# 3.6GB/S

THE TOP DATA TRANSMISSION SPEED RECORDED BY ERICSSON DURING A 5G MOBILE PHONE TEST.

Even better is that the data was received in a car travelling at up to 170Kph.

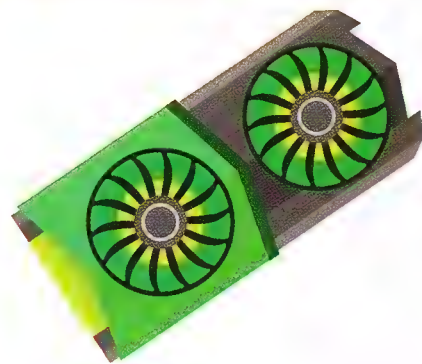
## 60+

SECONDS IS THE SHUTDOWN TIME FOR SOME WINDOWS 10 DEVICES WITH THE OCTOBER 2018 UPDATE INSTALLED. THE CAUSE SEEMS TO BE USB TYPE-C DEVICES BEING UNPLUGGED DURING SHUTDOWN.

# 56.8%

OF THE WORLD POPULATION IS NOW USING THE INTERNET, ACCORDING TO FIGURES FROM INTERNET WORLD STATS.

Half of those people are in Asia.



## 256GB/S

THE STAGGERING BANDWIDTH OF A PCI-E 6 X16 SLOT. THAT'S FOUR TIMES WHAT PCI-E 4 WILL GIVE. EXPECT TO WAIT UNTIL 2021 FOR COMPATIBLE DEVICES, THOUGH. ■

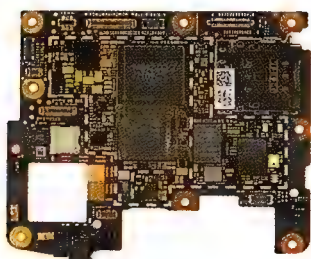


# how it's done

Although it would help, this phone was easy to open without heat.



This time around, we don't get a peep at Google's Pixel Visual Core.



## Google Pixel 3a

### Reading its entrails...

**T**he Pixel 3a breaks all the rules – a polycarbonate back panel, no wireless charging, visible bezels, a headphone jack, and a top-notch camera in a budget phone. Is there a method to Google's madness? Let's find out.

#### MAJOR TECH SPECS

- 5.6-inch OLED display with FHD+ 2,220x1,080 resolution (441 ppi) and Dragontrail Glass
- Octa-core 64-bit Qualcomm Snapdragon 670 processor (2.0GHz + 1.7GHz) with 4GB LPDDR4x RAM
- 12.2MP f/1.8 OIS main camera with dual-pixel phase detection autofocus; 8MP selfie camera
- 64GB built-in storage
- USB-C and a mysterious 3.5mm "headphone jack"
- Android 9.0 Pie

#### KEY FINDINGS

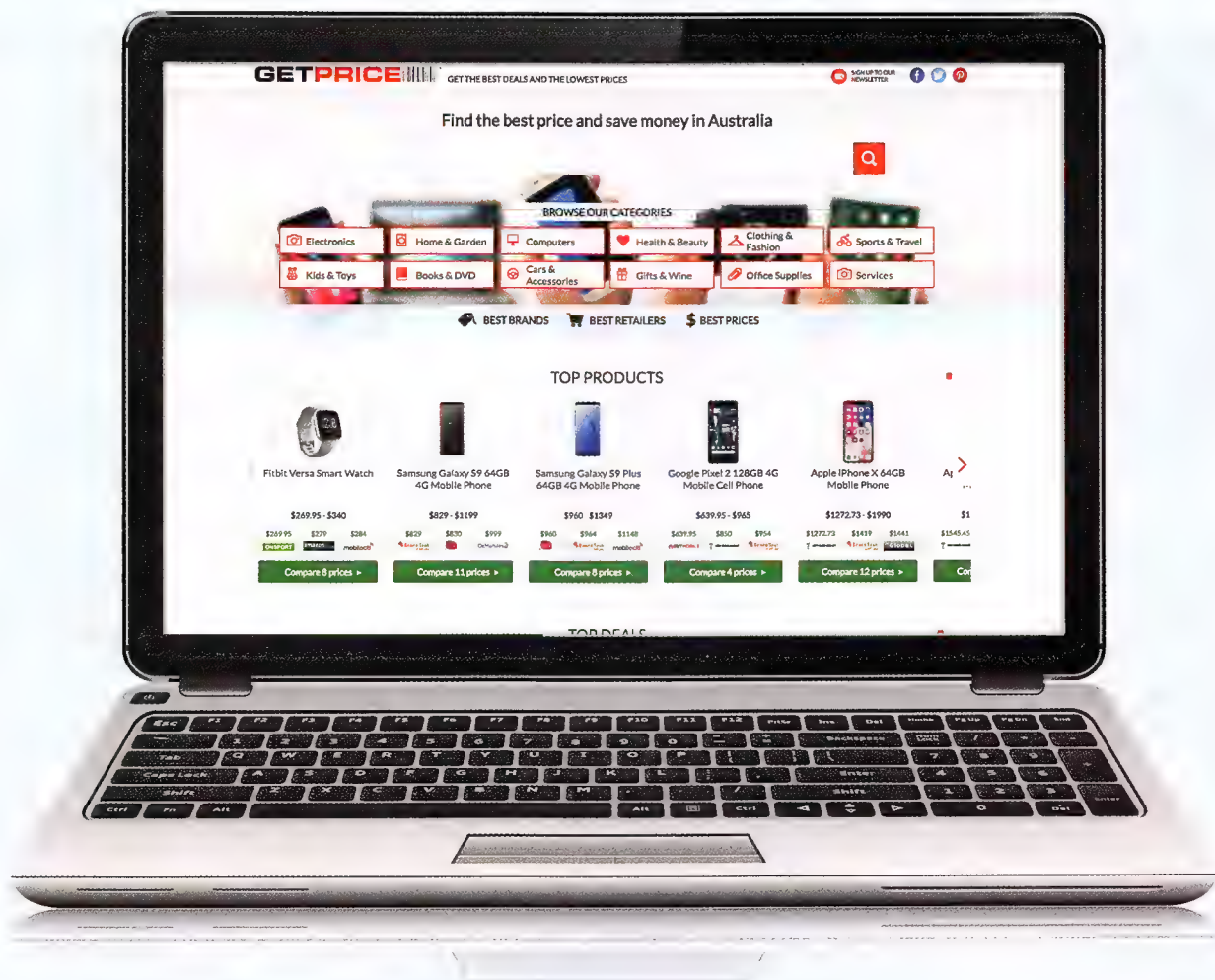
- The polycarbonate build should be more durable than a glass back, but it's likely no match for the rigidity of the metal construction of yore. Meanwhile, this Pixel's party piece – a rear camera like the one in the rest of the Pixel 3 line – promises serious firepower for a budget phone.

- Turning to the front, the 3a looks much like the Pixel 3, but with fewer seams. That seamless enclosure points to a screen-first entry – we're hoping it means easier screen replacements than on the Pixel 3. From the back, it's hard to tell the 3 and 3a apart. The Pixel 3a packs a slower processor and plastic construction, among other changes, to bring the price down a ton.
- A spongy, easily separated adhesive secures the display, which is good for repairs, but probably leaves the phone less than waterproof. We safely slice alongside the display and free it from the phone. Like old times, the display is connected to the motherboard by a ribbon cable. Also along for the ride is a Synaptics S3706 touchscreen controller.
- On our way to the battery, we fold aside a couple of golden flex cables for the Active Edge sensors. In Pixels past, these were routed under the battery; easy to destroy with prying. It's nice to see them out of harm's way. Onward to battery extraction, where two adhesive strips stand in the way. We locate the pull tabs and they co-operate with little fuss. This battery beats the Pixel 3's 11.2Wh one

with its own 11.55Wh powerhouse, falling between the iPhone XR and Galaxy S10e, at 11.16Wh and 11.94Wh respectively.

- The 3a inherits the well-reviewed 12.2MP rear camera from the Pixel 3. Instead of two 8MP selfie cameras, the 3a has only one, averaging the f/1.8 and f/2.2 apertures to f/2.0. We fish out the fingerprint sensor, complete with its wavy tail flex cable. At the bottom is a modular USB-C port, a welcome design for this high-wear component, especially as the 3a doesn't offer wireless charging. The headphone jack also makes a cool modular comeback.
- Repairability score: 6 out of 10 (10 is easiest to repair). Most components are modular and easily replaced once the display is removed. Repair-friendly stretch-release adhesive secures the battery. The only screws are standard T3 Torx ones. The display comes off first, but is thin and poorly supported. Foam adhesive makes opening easy. The myriad long, thin ribbon cables connecting the internal componentry can be obnoxious to work around. ■





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ULTRABOOK

\$TBC (FROM US\$1,700) | ACER.COM

## Acer Swift

Is this thin ultrabook as sharp as it seems or is Acer trying to pull a Swift one?

Being the leader in any way in the competitive ultrabook space is a big deal, and all of the companies making them go to great lengths to make their devices the thinnest and lightest available. Acer's new Swift 7 is the thinnest ultrabook right now. This is an impressive feat when considered in isolation, but once you weigh up all the things the Swift has to sacrifice to get there, those defining few millimetres of thickness won't seem worth it for many.

It takes a lot to get a device that is under a centimetre thick, especially when the best professional ultrabooks in the world are only just under 1.6cm. The Swift manages this by using a dual-core Intel Y series chip that has been designed to not need active thermal management. By jettisoning the need for fans to regulate component temperature the Swift 7 is able to shave off a

third of the total thickness.

The device's particularly sleek appearance is emphasised by an edge-to-edge 14-inch display that ditches the bottom bezel for a unique widescreen 16:9 chassis envelope. This elongated form factor throws up some unique spatial challenges on the keyboard side, but by moving the speakers to the underside of the unit and by stretching the trackpad the Swift 7 manages to turn this into a positive overall aesthetic. The keyboard has a nice amount of feedback and you actually use the edges of the wide trackpad more than you might initially think. There's even a pop up security camera and a fingerprint sensor for Windows Hello sign-in.

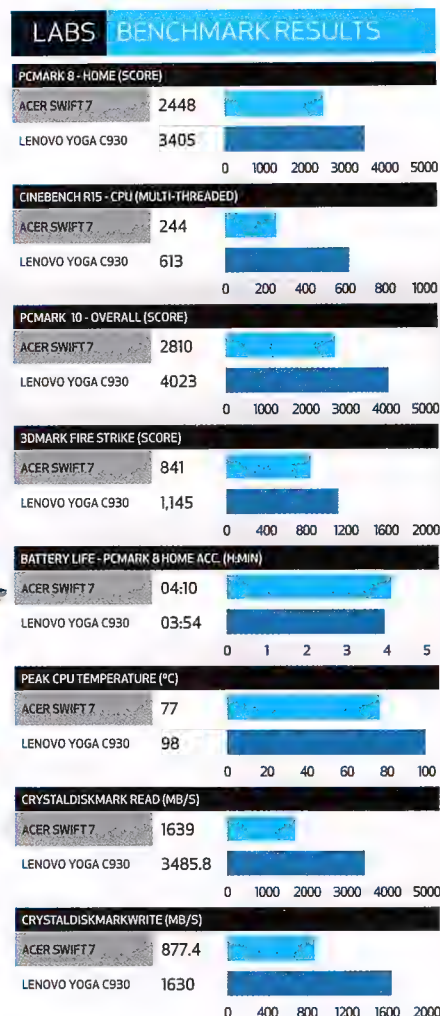
The screen of the Swift 7 is undoubtedly one of its highlights. While it's just a 14-inch FullHD IPS display, the glossy coating gives its colours a richness that makes everything from web pages to video playback look

great. The switch has also relocated the webcam to the keyboard allowing the screen to extend almost to the edge of the unit for an impressive 92% screen-to-body ratio. The display is even coated in a tactile Corning Gorilla Glass 6 touchscreen, for anyone who likes to interact directly with the display.

For many the features listed so far are likely to be the only things considered when buying a laptop, a fact that Acer is banking on. If you do happen to like being able to work without any performance dips or hindrances then you'll be keen to know that each of the cores on the i7-8500Y CPU is likely to be outperformed by between 30 and 50% by the cores commonly found on actively cooled ultrabooks. Combine this with the fact that 8th generation Intel processors transitioned to quad core arrangements and you can see raw compute performance of between

250 and 290% better on devices like the Lenovo Yoga C930 and the Huawei MateBook 13.

Despite this considerable performance cut the Swift 7 still seems to be priced in line with powerful professional ultrabooks with a starting price of US\$1,700, or roughly AU\$2,500 (we didn't have an official local RRP at the time of writing). If you add in the fact that it only gets six hours and 22 minutes in movie playback and the fact that it only has a 1st generation 1,500MB/s read PCIe SSD, it's a little behind the curve. ■ Joel Burgess



## Verdict

A sleek device with a nice screen that does away with excess processing power but keeps the premium price tag.







LAPTOP

\$7,399 | WWW.MSI.COM

# MSI GT76 Titan DT 9SG

Does MSI's latest gaming goliath pack enough firepower to justify its gigantic price tag?

**M**SI's GT range has always been ludicrous. Starting at \$5,899 a pop these devices really aren't going to appeal to many consumers, especially when you consider they basically weigh as much as a gaming tower, without offering identical performance. MSI however continues to make the GT76, we presume, to show off just how much power it can fit into a 'portable' device.

The GT76 Titan is built around the 9th generation, overclockable, octa-core Core i9-9900K CPU from Intel that adds two cores to the hexa-core i9-8950HK processor that was in the GT75 Titan. This means that the GT76 Titan has four fans, 11 heat pipes and a lot of thermal mass to dissipate the considerable amount of heat this component is capable of generating. When

you combine this with the device's Nvidia GeForce GTX 2080 GPU and 32GB of RAM the chassis of this unit balloons to an unwieldy 4cm thick case and 4.2kg weight.

From the front this gargantuan device actually looks like a standard 17-inch gaming laptop, but what you're seeing is just the tip of the iceberg, since the back kicks out another 10cm behind the screen and the base is so thick it feels like the unit is propped up on a riser. The 17.3 inch screen can be configured as either a 4K, 60Hz display or a FullHD one with a super fast 240Hz refresh rate and both of these make sense considering how much power the laptop has.

The CPU is the first octa-core processor we've seen on a 'mobile' device, and unlike its predecessor, it's fully unlocked to be overclocked to the 5GHz limit. We did actually see

those internal clocks hitting 4990MHz under load with individual cores scoring 213 on Cinebench R15's Single-core CPU test, 2.9% higher than the GT75. The additional cores of the 9900K added some weight to the combined CPU Cinebench R15 score of 2043, but it can't account for all of the 47% bump over last year's GT75. The GT76 Titan has clearly benefited greatly from being overclocked at the factory.

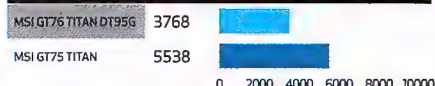
We didn't see quite the same performance bumps across graphically intensive tasks, despite the update from a GTX GeForce 1080 to an RTX 2080 GPU. In 3Dmark's Time Spy benchmark there was a 40% bump in scores, but this translated to less than 3% improvement in *Ghost Recon: Wildlands* and *Far Cry: Primal* frame rates at Ultra 1080p settings. *Total War: Warhammer 2* was an exception to this rule with

frame rates of 98.8fps at 1080p Ultra on the GT76, 49% more than the GT75. *Ghost Recon: Wildlands* gets 36fps averages using 4K resolution at Ultra settings and the GT76 is capable of getting over 100 fps on many modern games at FullHD resolutions.

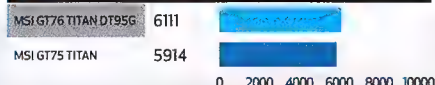
Naturally the battery life on this power hungry device is pretty shoddy, lasting just two hours and 32 minutes for 1080p movie playback, but we have no complaints about the 1TB of speedy RAID 0 PCIe SSD storage and the additional 1TB of SATA SSD space. ■ Joel Burgess

## LABS BENCHMARK RESULTS

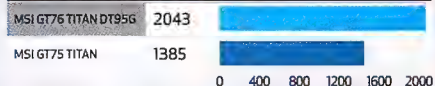
### PCMARK 8 - HOME (SCORE)



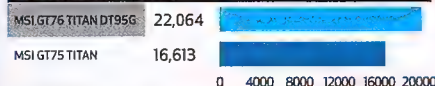
### GEEKBENCH 4 - SINGLE CORE



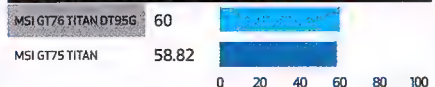
### CINEBENCH R15 - MULTI-THREADED CPU



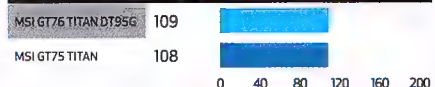
### 3DMARK FIRE STRIKE (SCORE)



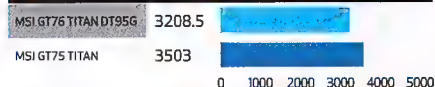
### GHOST RECON WILDLANDS - ULTRA 1080P (FPS AV)



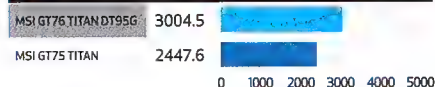
### FAR CRY PRIMAL - ULTRA 1080P (FPS AV)



### CRYSTALDISKMARK READ (MB/S)



### CRYSTALDISKMARK WRITE (MB/S)



## Verdict

If you need the pinnacle of power and will spare any cost to get it then the GT76 Titan packs a punch.







## BUSINESS LAPTOP

FROM \$2,734 | [DELL.COM/EN-AU/](https://www.dell.com/en-au/)

# Dell Latitude 5400

A 14-inch business laptop that'll keep working longer than you can.

There's nothing stopping you buying Dell's Latitude 5400 as a regular consumer, but Dell do pitch this device directly to businesses and there's good reason for that. Starting at an eye-watering \$2,734 is the entry level Latitude 5400, equipped with a middling Intel Core i5 CPU, 8GB of RAM and a small 256GB NVMe SSD. All this comes wrapped in a bulky formed plastic case that isn't flimsy but is about the most function over form solution you could possibly imagine.

To put this in perspective, you can currently buy the refined Gigabyte Aero 15 OLED ultrabook with a 4K display, a 9th generation Intel Core i7 CPU, 8GB of RAM, a 256GB PCIe SSD and a Nvidia GeForce GTX 1660Ti for less. There is also an abundance of laptops available that offer similar component configurations and a

Windows 10 Pro OS from anywhere between \$700 and \$1,700 less than this RRP. The Latitude 5400 did have a 40% off discount promotion running at the time of writing which at least puts it in the ballpark of Core i5 business laptops, but there is still an abundance of better value options available, even with this discount.

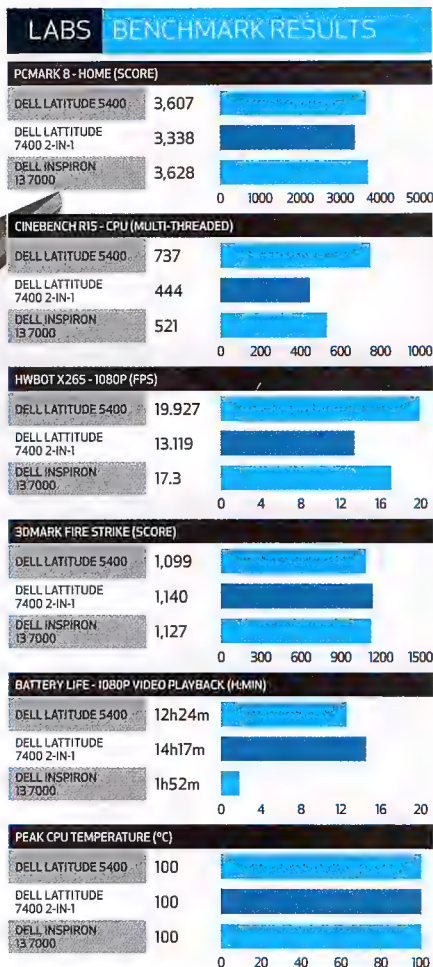
Putting value aside, there are a couple of ways in which the Latitude 5400 is actually exceptional. The most prominent of these is battery life. While the device only managed four hours and 33 minutes under load in the demanding PCMark 8 Battery Life benchmark it lasted 12 hours and 23 minutes during 1080p movie playback. Considering the 68Wh battery isn't huge, this longevity can be attributed to the efficiency of the CPU, which conserves power while performing less demanding tasks.

Part of this lifespan might be attributed to the 14-inch FullHD LCD screen that runs at a peak brightness of 220 nits. While it offers wide-angle viewing and an anti-glare matte finish, it did look slightly more dull than what we were used to on consumer 1080p panels.

While it might not be wrapped in the most appealing package, the Latitude 5400 does weigh just 1.5 kg and slips in under the 2cm thick mark making it exceptionally portable. The starting model only offers a 256GB PCIe SSD, but most workplaces will have cloud storage these days, so it isn't really imperative to have a heap of on-device storage and there's the option to upgrade to 512GB if you do need it. With read and write speeds of 1,629 and 861MB/s respectively, it's not the fastest SSD available, but it is still two to three times faster than

an SSD using a SATA 3 interface.

The individual CPU cores did surprisingly well in single-core Cinebench R15 tests, scoring higher than any laptop we've tested in the last year or so. These results level out a little more across holistic CPU work tasks, but the Latitude 5400 still did particularly well in PCMark 8 Work benchmarks performing better than premium devices like the Huawei MateBook 13. While this performance was exceptional, the unit did see the CPU regularly spike to 100°C, which is likely to shorten the overall lifespan of the device. **Joel Burgess**



## Verdict

A powerful and long-lasting work laptop that great value if you can get it on-sale for 50% of its RRP.







GAMING MONITOR

\$3,999 | WWW.ACER.COM/AU

# Acer Predator X35

Is this the holy grail of gaming monitors, or just a sacrilegiously expensive one?

**T**icking off just about every monitor spec a modern PC gamer could dream of, this 35-inch LED-backlit VA screen from Acer has been a long time coming. First revealed back in August 2017, the X35 has taken nearly two years to come to market, and it's joined by near-identical competitors from Asus and AOC, with all three employing the same ultrawide panel from AU Optonics (AUO).

We've seen similar 35-inch, 21:9 gaming screens before, with an earlier generation of AUO screens from 2017 still widely available, offering more sedate specs (a 100Hz max refresh rate with FreeSync) at a still-pricey \$1,000 to \$1,500 in Australia.

At an eye-watering \$3,999, this Acer model is in another league entirely, putting it out of reach of all but the most well-heeled of gamers. But that said, there's nothing that even comes close when it comes to specs: that curved panel promises a 200Hz refresh rate alongside

G-Sync, DisplayHDR 1000 support, full-array local dimming (FALD) backlights and a designer-friendly 90% DCI-P3 colour gamut. Its 3,440 x 1,440-pixel resolution doesn't need an array of top-shelf cards to drive it... well, not unless you want to hit 200 frames per second to match that refresh rate.

Out of the box, its colour accuracy is excellent too – we ran it through an X-Rite i1Display Pro calibration, and found it matched Adobe RGB/6500K settings without any tweaking required, and its colour uniformity was also outstanding, with exceptional backlight evenness and no indications of light bleed around the edges – so it's immediately ready to go for basic colour-accurate design work.

This really is a monitor that's intended for entertainment, though, and there it doesn't disappoint either. In games that support high dynamic range colours (such as *Metro: Exodus* and *Shadow of the Tomb Raider*) that DisplayHDR 1000 spec

– the second highest available – translates to an immediately noticeable bump in image depth when activated. Blacks are deeper and with more subtle detail, and bright colours pop with more vibrancy and realism, and that broader colour range imparts a much greater sense of three-dimensionality overall.

When coupled with that 200Hz overclocked refresh rate (it can hit 180Hz natively, but we had no issues running it at top speed in terms of image quality or glitches) and G-Sync, that adds up to an unmatched gaming experience, particularly in first and third-person titles, where the onscreen action feels more immediate and responsive than on any other monitor we've ever tested.

Subjectively speaking, this 35-inch size also feels significantly more substantial than the more common 34-inch ultrawide gaming screens – the extra physical vertical height means it fills more of your natural field of view, and

doesn't feel like a narrow viewport.

There's one glaring fault with the X35, however, and that's ghosting. VA panels have been a bit notorious for this in the past, and the problem's particularly noticeable when you have a dark-black element against a lighter background, with that high-contrast visual causing dark trails to lag along behind the black area when it's in motion.

As much as we love the other aspects of this display, however, for this kind of price we'd be expecting perfection – and unless you never play games with these kind of high-contrast visuals, we'd have trouble recommending this otherwise stonkin' screen. ■

Dan Gardiner

## Verdict

Amazing specs and mind boggling performance are undermined by the old VA panel bugbear: ghosting.







# AMD Ryzen 5 3400G and Ryzen 3 3200G

Gaming on a tight budget? Have a look at these.

**A**MD has had a lot of time in the limelight with the recent release of its Ryzen 3 series processors. It's easy to forget though that the company made a name for itself with its so-called APUs (Accelerated Processing Units), which come with integrated graphics. Here for review we have the latest generation Ryzen 3 3200G and Ryzen 5 3400G processors. These don't make use of the latest Zen 2 architecture or 7nm like their big brothers, instead making use of the older 12nm process and the Zen+ architecture.

Moving to Zen+ and 12nm means these processors can be considered evolutionary rather than revolutionary. Second generation APUs already had competitive value and performance along with class-leading integrated graphics. The

3200G and 3400G are all about offering a balanced computing experience by incorporating a quad core design and integrated graphics capable of 1080p gaming.

The AMD Ryzen 5 3400G is a 4-core/8-thread AM4 model with 3.7GHz and 4.2GHz boost clocks. This is a 100MHz and 300MHz increase in base and boost clocks over the 2400G. The graphics configuration remains the same, with 11 Vega compute units clocked at 1400MHz, up from the 2400G's 1250MHz. The TDP remains at 65W. More performance within the same power budget is always welcome.

The Ryzen 3 3200G gets a similar bump in spec. It's still a 4-core/4-thread processor with eight Vega compute units. It comes with 3.6GHz base and 4.0GHz boost clocks along with a 1250MHz GPU clock. Compared to the 2200G, this

represents a 100MHz jump in base clock, an impressive 300MHz boost clock gain and a 150MHz GPU clock speed improvement.

Both APUs come with bundled coolers. The Wraith Spire included with the 3400G is decent, while the Wraith Stealth with the 3200G is adequate, but nothing more.

As expected the integrated graphics performance of both processors simply destroys the Intel HD 630 found across most of Intel's desktop range. Though you won't be playing AAA titles at 4K, it's nice to see playable 1080p, even if it's at low settings. Less demanding games like CS:GO are perfectly playable even at maximum settings. Of course you can always add a discrete GPU later on if you choose.

CPU performance is no match for the likes of a Ryzen 5 2600X let alone the

Zen 2 models but remember these cost \$145 and \$239. They're perfectly suited to everyday tasks that the majority of mainstream users need them for. These are the kinds of processors that put a nail in the coffin of any and all dual core CPUs.

The Ryzen 3 3200G and 3400G deliver class-leading all round performance in this price range. They're cool running and power thrifty.

■ Chris Szewczyk

## Verdict

AMD's APUs deliver a superlative combination of CPU and GPU performance and excellent value.

AMD RYZEN 3 3200G



AMD RYZEN 5 3400G







CPU  
\$315 & \$389 | WWW.AMD.COM

# AMD Ryzen 5 3600 and Ryzen 5 3600X

Are they the new mid-range champions?

**W**e were full of praise for AMD's new 3rd generation Ryzen processors. While the higher-end eight and 12 core CPUs occupy the performance segment, the hex core Ryzen 5 3600 and Ryzen 5 3600X fill the popular \$300 to \$400 price void nicely. They both have all the 3rd generation tech, features and performance under the hood. Now AMD can add mainstream affordability too. Are these CPUs the new price/performance champions?

The 3600X comes with a 200MHz increase on base and boost speeds when compared to Ryzen 5 2600X. The L3 cache is doubled and DDR4-3200 is officially supported. Add in all the cumulative architectural benefits of Zen 2 and it's clear we're dealing with a much faster CPU. TDP remains at 95W.

The 3600 is in our opinion

the more enticing of the two. With its 3.6GHz base clock and 4.2GHz boost clock it's 200MHz slower than the 3600X, but it's also cheaper and comes with a 65W TDP making it more suitable to small form factor or a noise minimised build. You're not really losing that much in performance either. About the only real weakness is the very basic Wraith Stealth cooler which isn't great compared to the bigger Wraith Spire that comes with the 3600X.

Both 3600 processors exhibit very strong multithreaded performance, beating out the still quite beastly Intel i7-8700K. Gaming performance is also competitive. Not bad at all when you consider Intel's clock speed advantage. Intel still has its nose in front in pure maximum FPS gaming, but not necessarily at every price point. Remember that in a GPU-limited scenario, any gaming FPS advantage

essentially evaporates. Overall, the 3600 and 3600X are better balanced across a range of workloads.

Power consumption and temperatures for both models are impressive. We used our Corsair H100i Pro 240mm AIO cooler and maxed out at 64C with the 3600. The 3600X was only a couple of degrees more. Bear in mind that we're in winter, so temps in a closed case in summer will be higher. Power consumption results were enlightening too. We recorded a peak system power consumption of 154W vs 144W for the 3600, not as much of a difference as we expected.

AMD continues to kick goals. The 3600 and 3600X carry all of the 3rd generation's features and strengths combined with excellent value. At \$315, the 3600 in particular is simply outstanding. It's much cheaper than a 9600K and has no real competition at

its price point. The 3600X is of course faster than the 3600, but not by much. Pair either one of these processors with an affordable B450 or X470 motherboard and you'll get a very well balanced system and have a few extra dollars to put towards a faster GPU or bigger SSD. We think the 3600 is the more compelling out of the two as it's cheaper, uses a little less power and isn't far behind on performance. Either one will serve you well across a range of workloads though. ■ Chris Szewczyk

## Verdict

AMD's Ryzen 5 3600X and 3600 in particular deliver a fantastic blend of performance, features and value.

AMD RYZEN 5 3600

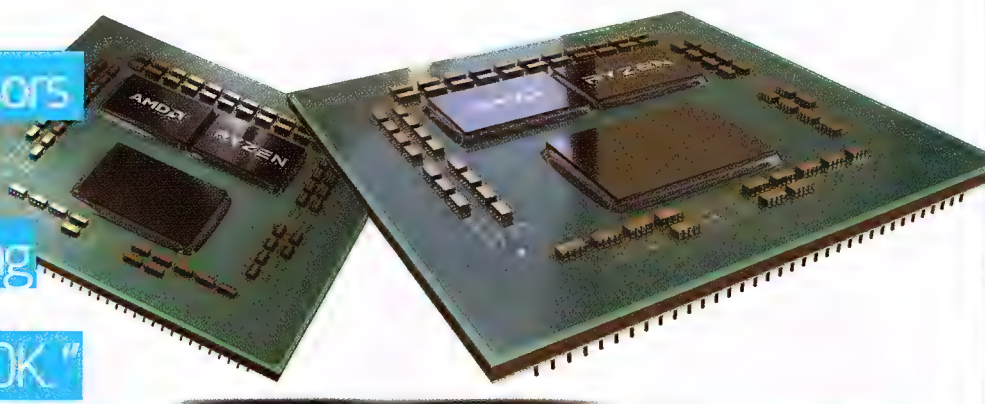


AMD RYZEN 5 3600X





"Both 3600 processors exhibit very strong multithreaded performance, beating out the still quite beastly Intel i7-8700K."



#### AMD RYZEN BENCHMARK RESULTS

|                                 | X264 FHD VIDEO ENCODING<br>FPS | CINEBENCH R20<br>MULTI THREAD SCORE | CINEBENCH R20<br>SINGLE THREAD SCORE | 7ZIP<br>MILLION INSTRUCTION PER SECOND |
|---------------------------------|--------------------------------|-------------------------------------|--------------------------------------|----------------------------------------|
| INTEL CORE I7-8700K (W/1080 TI) | 46.2                           | 3,451                               | 479                                  | 40,313                                 |
| AMD RYZEN 7 3700X (W/1080 TI)   | 56.2                           | 4,803                               | 501                                  | 57,576                                 |
| AMD RYZEN 2600X (W/1080 TI)     | 44.1                           | 3,079                               | 428                                  | 37,453                                 |
| AMD RYZEN 5 3600 (W/1080 TI)    | 48.0                           | 3,600                               | 477                                  | 43,752                                 |
| AMD RYZEN 5 3600X (W/1080 TI)   | 49.6                           | 3,735                               | 503                                  | 45,062                                 |
| INTEL CORE I5-8400              | 34.0                           | 2,292                               | 409                                  | 26,439                                 |
| AMD RYZEN 5 2400G               | 28.0                           | 1,846                               | 386                                  | 22,093                                 |
| AMD RYZEN 3 2200G               | 21.9                           | 1,428                               | 358                                  | 15,782                                 |
| AMD RYZEN 3 3200G               | 23.0                           | 1,531                               | 390                                  | 16,396                                 |
| AMD RYZEN 5 3400G               | 30.1                           | 1,929                               | 403                                  | 23,100                                 |

#### AMD RYZEN BENCHMARK RESULTS

|                                 | CPUZ<br>SINGLE AND MULTI<br>THREADED SCORE | BLENDER 2.79 BMW RENDER<br>TIME (SECONDS) LOWER<br>IS BETTER | TIME SPY PHYSICS<br>SCORE | MIDDLE EARTH: SHADOW<br>OF WAR<br>1080P, LOW, DX12, AVG FPS |
|---------------------------------|--------------------------------------------|--------------------------------------------------------------|---------------------------|-------------------------------------------------------------|
| INTEL CORE I7-8700K (W/1080 TI) | 517.4   3838.9                             | 312.6                                                        | 7571                      | 213                                                         |
| AMD RYZEN 7 3700X (W/1080 TI)   | 530.7   5588.6                             | 235.2                                                        | 9939                      | 206                                                         |
| AMD RYZEN 2600X (W/1080 TI)     | 471.6   3711.5                             | 347.3                                                        | 6599                      | 183                                                         |
| AMD RYZEN 5 3600 (W/1080 TI)    | 505.1   4063.6                             | 311.5                                                        | 7231                      | 199                                                         |
| AMD RYZEN 5 3600X (W/1080 TI)   | 528.8   4208.7                             | 301.2                                                        | 7447                      | 205                                                         |
| INTEL CORE I5-8400              | 464.0   2584.7                             | 489.7                                                        | 4954                      | 18                                                          |
| AMD RYZEN 5 2400G               | 439.1   2310.6                             | 573.1                                                        | 3598                      | 36                                                          |
| AMD RYZEN 3 2200G               | 428.0   1674.5                             | 848.3                                                        | 3365                      | 32                                                          |
| AMD RYZEN 3 3200G               | 462.0   1775.7                             | 798.6                                                        | 3297                      | 34                                                          |
| AMD RYZEN 5 3400G               | 469.7   2453.5                             | 530.5                                                        | 3744                      | 38                                                          |

#### AMD RYZEN BENCHMARK RESULTS

|                                 | GHOST RECON: WILDLANDS<br>1080P, LOW, AVG FPS | COUNTER-STRIKE: GLOBAL<br>OFFENSIVE<br>1080P MAX SETTINGS, AVG FPS |
|---------------------------------|-----------------------------------------------|--------------------------------------------------------------------|
| INTEL CORE I7-8700K (W/1080 TI) | 181.4                                         | 424.7                                                              |
| AMD RYZEN 7 3700X (W/1080 TI)   | 174.1                                         | 435.0                                                              |
| AMD RYZEN 2600X (W/1080 TI)     | 159.9                                         | 362.5                                                              |
| AMD RYZEN 5 3600 (W/1080 TI)    | 172.5                                         | 416.0                                                              |
| AMD RYZEN 5 3600X (W/1080 TI)   | 171.4                                         | 425.8                                                              |
| INTEL CORE I5-8400              | 11.7                                          | 21.1                                                               |
| AMD RYZEN 5 2400G               | 33.4                                          | 70.9                                                               |
| AMD RYZEN 3 2200G               | 28.9                                          | 64.0                                                               |
| AMD RYZEN 3 3200G               | 30.6                                          | 68.2                                                               |
| AMD RYZEN 5 3400G               | 35.0                                          | 74.1                                                               |





# NVIDIA RTX 2080 SUPER

A better RTX 2080.

**H**ot on the heels of the RTX 2060 Super and 2070 Super comes the RTX 2080 Super. It's the third and final Super card that Nvidia plans to release. The 2060 and 2070 Supers (reviewed in APC 471) were released to counter the challenge of AMD's Navi GPU, but had the additional effect of leaving the 2080 uncomfortably close in performance to the 2070 Super. The RTX 2080 Super unlocks the full capabilities of the TU104 GPU in order to keep it comfortably ahead of AMD as well as achieving the rebalancing of the lineup that Nvidia needed. As the 2080 Ti sits unchallenged at the top of the product stack, it's unlikely we'll ever see a 2080 Ti Super.





"The base GPU is capable of boosting to 1815MHz compared to the 1710MHz of the original 2080. So, we've got more shaders, more bandwidth and faster clocks."

The original RTX 2080 is equipped with the TU104 GPU with 2,944 of the maximum 3,072 cores unlocked. The RTX 2080 Super comes with all 3072 cores unlocked. Further resources are also available, including 384 Tensor cores and 48 RT cores (compared to the original's 368 and 46). The second major improvement is the inclusion of faster GDDR6 memory rated at 15.5GB/s compared to the 14 GB/s of the original, a handy 10% gain. Finally the 2080 Super comes with higher clock speeds. The base GPU is capable of boosting to 1815MHz compared to the 1710MHz of the original 2080. So, we've got more shaders, more bandwidth and faster clocks. It's not revolutionary, but when you're starting with strong base, that's not a bad thing at all.

These gains come at the cost of increased power consumption. A rise from 225W to 250W isn't too much to worry about thankfully, as today's high end GPU coolers don't struggle with this kind of TDP. 250W means custom cards likely to be equipped with 8+8pin connectors.

As you'll see in our reviews, the 2080 Super is exactly that, the 2080, but a bit better. The gains over the non Super version aren't as big as those we saw for the 2060 and 2070. 2080 users shouldn't feel aggrieved, unless you bought one very recently, while 2080 Ti users have nothing to worry about. The 2080 Super does exactly what it's intended to do. It narrows the gap between the 2070 Super and 2080 Ti. It provides a solid gaming experience and of course comes with all the forward-looking RTX features that we've come to expect. Though the 2080 Super is supposed to be cheaper than the outgoing 2080, \$1,000+ is still a lot of money to pay for a GPU. If you've got the

dosh, you'll be happy with the performance on offer but we can't help but think that Nvidia's pricing is still too high at every price point.

It's now a year since the release of the RTX series. A mid-life refresh is welcome, but after a year we start to look forward once more. 7nm RTX? A big Navi GPU? It's optimistic to think we'll see anything new in the remainder of 2019, but something is always cooking, of that you can be sure.

| RTX GRAPHICS CARD BENCHMARKS          |                 |      |          |        |                             |
|---------------------------------------|-----------------|------|----------|--------|-----------------------------|
|                                       | TEMPERATURES °C |      | 3DMARK   |        | GEEKBENCH GPU COMPUTE SCORE |
|                                       | IDLE            | LOAD | TIME SPY | FSE    |                             |
| NVIDIA GEFORCE GTX 1080 TI            | 37              | 79   | 9,464    | 13,055 | 209,240                     |
| NVIDIA GEFORCE RTX 2080               | 37              | 72   | 10,864   | 12,700 | 295,913                     |
| AMD RADEON VII                        | 39              | 78   | 8,914    | 12,252 | 233,124                     |
| NVIDIA GEFORCE RTX 2060 SUPER         | 37              | 72   | 8,936    | 10,296 | 252,528                     |
| NVIDIA GEFORCE RTX 2070 SUPER         | 35              | 70   | 9,936    | 11,554 | 273,974                     |
| AMD RADEON RX 5700 XT                 | 38              | 84   | 8,843    | 11,551 | 337,712                     |
| NVIDIA GEFORCE RTX 2080 SUPER         | 37              | 74   | 11,095   | 13,190 | 312,139                     |
| ASUS ROG STRIX GEFORCE RTX 2080 SUPER | 34              | 66   | 11,366   | 13,483 | 317,238                     |

| RTX GRAPHICS CARD BENCHMARKS          |                                                      |           |           |                                          |           |           |                                          |           |           |                                                 |           |           |
|---------------------------------------|------------------------------------------------------|-----------|-----------|------------------------------------------|-----------|-----------|------------------------------------------|-----------|-----------|-------------------------------------------------|-----------|-----------|
|                                       | GHOST RECON WILDLANDS<br>(VERY HIGH PRESET. AVG FPS) |           |           | METRO: EXODUS<br>(ULTRA PRESET. AVG FPS) |           |           | SHADOW OF WAR<br>(ULTRA PRESET. AVG FPS) |           |           | SHADOW OF THE TOMB RAIDER<br>(HIGHEST. AVG FPS) |           |           |
|                                       | 1920X1080                                            | 2560X1440 | 3840X2160 | 1920X1080                                | 2560X1440 | 3840X2160 | 1920X1080                                | 2560X1440 | 3840X2160 | 1920X1080                                       | 2560X1440 | 3840X2160 |
| NVIDIA GEFORCE GTX 1080 TI            | 113.8                                                | 88.4      | 54.8      | 72.8                                     | 57.3      | 36.0      | 123                                      | 88        | 51        | 117                                             | 80        | 43        |
| NVIDIA GEFORCE RTX 2080               | 116.3                                                | 89.7      | 54.3      | 80.8                                     | 63.2      | 39.9      | 133                                      | 98        | 60        | 125                                             | 88        | 47        |
| AMD RADEON VII                        | 102.1                                                | 81.9      | 51.5      | 70.2                                     | 57.2      | 37.3      | 124                                      | 87        | 54        | 123                                             | 85        | 45        |
| NVIDIA GEFORCE RTX 2060 SUPER         | 102.6                                                | 78.6      | 45.5      | 63.5                                     | 49.5      | 30.7      | 111                                      | 79        | 48        | 103                                             | 70        | 37        |
| NVIDIA GEFORCE RTX 2070 SUPER         | 107.1                                                | 83.8      | 51.5      | 73.1                                     | 57.0      | 35.7      | 123                                      | 89        | 55        | 115                                             | 80        | 42        |
| AMD RADEON RX 5700 XT                 | 105.9                                                | 83.8      | 50.5      | 70.3                                     | 56.1      | 34.2      | 116                                      | 77        | 45        | 115                                             | 77        | 39        |
| NVIDIA GEFORCE RTX 2080 SUPER         | 122.6                                                | 95.5      | 58.3      | 84.5                                     | 66.1      | 41.6      | 140                                      | 104       | 64        | 135                                             | 93        | 49        |
| ASUS ROG STRIX GEFORCE RTX 2080 SUPER | 124.9                                                | 97.4      | 60.0      | 86.1                                     | 67.2      | 42.3      | 143                                      | 105       | 64        | 138                                             | 95        | 51        |





N/A | [WWW.NVIDIA.COM](http://WWW.NVIDIA.COM)

# NVIDIA GeForce RTX 2080 Super

A 2080 with a little bit more.

Externally, the RTX 2080 Super Founders Edition looks almost identical to its non-super sibling. The exception is the addition of a classy mirror finish on the face of the card. It retains the impressive build quality, design and overall aesthetic that we like from all the other RTX Founders Edition cards. It comes with a 1,815 MHz boost clock, which as usual is quite conservative. You can expect clocks well above this if thermal and power conditions allow. We have received word that the Founders Edition card won't be on sale in Australia, though it will be available in many OEM systems.

The RTX 2080 Super FE uses the same PCB as the non-Super 2080. An 8+2-phase DrMOS VRM system is adequate, but won't match the likes of the Asus Strix card in terms of VRM quality. Unless you're into LN2 cooling though, this won't make any practical difference.

The FE card's display connectivity consists of

three DisplayPort 1.4a outputs along with a single HDMI 2.0b connector. The VirtualLink USB Type-C connector designed for VR headsets is also carried over.

The performance on offer from the 2080 Super FE is impressive, but isn't much of a gain over the vanilla 2080. It's able to game 4K and is a particularly strong choice for use with a high refresh rate 1440p monitor.

The RTX 2080 Super is an improvement by almost every measure. It offers a terrific set of forward looking features, but a 4K gaming card doesn't go for cheap. If you don't mind paying, then the RTX 2080 Super Founders Edition is a very good card.

## Verdict

The Nvidia RTX 2080 Super FE doesn't offer anything new, but does everything a little bit better.



**SPECIFICATIONS:** Nvidia GeForce RTX 2080 Super Founders Edition, 3072 Cuda Cores, 1650 MHz Base Clock, 1815 MHz Boost Clock, 8GB GDDR6 15.5Gbps memory, 496GB/s Memory Bandwidth, 3x Display Port 1.4, 1x HDMI 2.0b, 1x 8-Pin, 1x USB Type-C; 1x 8-Pin, 1x 6-Pin Power Connector, 250W TDP.



\$1,479 | [WWW.ASUS.COM/AU](http://WWW.ASUS.COM/AU)

# ASUS ROG Strix GeForce RTX 2080 Super

A souped up 2080 Super.

If the RTX 2080 Super is an improvement over the standard 2080, then the Asus ROG Strix 2080 Super is on another level again. It's faster, cooler, quieter, has a better build and arguably a better look. It's no surprise that it comes with a higher price too.

GPU spec-wise, the Asus and FE cards are essentially identical, though the Asus boost clock is higher and it drops one of the Display Ports in favor of an additional HDMI 2.0b port. The Asus comes with a host of additional extras though including RGB lighting, dual BIOS, voltage read points, and of course that delightfully over the top cooler and massively over-engineered power delivery system that can provide the GPU with more juice than Nvidia would ever be comfortable with. It's a real powerhouse of a card, whether you like something cool and quiet, something to show off in a windowed case or you want to overclock the hell out of

it, you'll be impressed by the Asus Strix.

The Asus Strix had a consistent performance lead over the Founders Edition 2080 Super, but not by as much as we expected. Still, it's hard to argue with that when it's the fastest non 2080 Ti we've ever tested. It's also amazingly cool and quiet. Despite a 250W TDP, the monstrous Asus cooler can barely be heard above our already quiet AIO CPU cooler.

Asus have created a stunningly high end graphics card that's an improvement in every way over the already very good Founders Edition card. As is the case with many top end Asus cards, that impeccable quality comes with a price.

## Verdict

A very strong RTX 2080 Super card, but also one of the most expensive.



**SPECIFICATIONS:** Asus ROG Strix RTX2080S-O8-Gaming, 3072 Cuda Cores, 1650MHz Base Clock, 1890MHz Boost Clock (OC Mode), 8GB GDDR6 15.5Gbps memory, 496GB/s Memory Bandwidth, 2x Display Port 1.4, 2x HDMI 2.0b, 1x USB Type-C; 2x 8-Pin Power Connectors.





ROUTER

\$370 | WWW.DRAYTEK.COM.AU

# DrayTek Vigor2133Vac

An affordable yet powerful and flexible router for home office or small business use.

**T**he DrayTek Vigor2133 series comes in a range of options to suit different needs without blowing out the budget. We tested the top spec Vigor2133Vac which features AC1200 spec Wi-Fi (867Mbps + 300Mbps) and dual VoIP ports for \$370. The slightly cheaper 2133ac leaves out the VoIP, bringing the price down to \$340. The Vigor2133n has no VoIP and 802.11n Wi-Fi for just \$250, while the plain Vigor2133 has no WiFi or VoIP and will set you back \$210. The rest of the specs are the same, which makes the Vigor2133 series an extremely flexible option that allows the purchase of only the features needed.

The Vigor2133 series is NBN ready with a GbE WAN port, as well as four GbE LAN connections. You also get dual USB 2.0 ports, which can be used to drive a printer, or connect a USB

3G/4G modem. The 2133Vac model tested also had two FXS VoIP ports, so you can plug in a phone directly and manage bandwidth use to maintain top notch call quality.

The removable Wi-Fi antennas are not huge and during testing we managed 287 Mbps at 2m from the AC1200 router, dropping to 139 Mbps at 10m – which while not terrible, could be better. Really though, the Vigor2133 is designed to be part of a larger network, and can manage two external wireless access points. The 2133 series router itself can also be remotely managed and monitored via the comprehensive VigorACS 2 system. To allow for users remotely connecting to the network, or for linking distant office networks, the router supports two SSL VPN tunnels. While not idiot proof, the VPN tunnels are easy to get up and running, and very stable. The 2133 series also

has the typical business critical features, with a robust firewall that can do everything from stopping denial of service attacks, to restricting social media use during office hours. The Vigor2133 also support up to 8 VLANs (and 4 IP subnets), and can be used to manage both wired and wireless bandwidth across the network. The DrayTek router also includes some very handy management options for a USB 3G/4G modem, allowing it to be used as a failover backup to the main connection, or even boost bandwidth in high load times or for priority traffic. Not only does this give a critical backup in case your main internet goes down, it means the 2133 can also be deployed in the field to provide Wi-Fi in the field or at events.

While very functional, the Vigor2133 interface can be a little

intimidating and lacks the polish of simpler home focused routers. But that's a worthy tradeoff, considering the rich features, and DrayTek has loads of helpful how to articles available on their website that will walk new users through most configurations.

Overall the Vigor2133Vac did everything it says on the box without a hitch, and is easy enough to get up and running. The pricing of the different spec models is decent, and while we wish the Wi-Fi was a little faster, and it supported additional VPN tunnels, the Vigor2133 series is a compelling buy.

■ Lindsay Handmer

## Verdict

Excellent pricing, 4G redundancy options and comprehensive features make up for slightly slow Wi-Fi.







"The main benefit of a NAS specific drive is that they're designed with 24/7 operation in mind."



STORAGE

16TB IRONWOLF - \$959, 16TB IRONWOLF PRO - \$1,059 | SEAGATE.COM

# Seagate 16TB Ironwolf & Ironwolf Pro HDDs

Seagate's flagship NAS hard drives get a big capacity bump.

**G**ood news data hoarders, there's now a 16TB variant of Seagate's popular Ironwolf and Ironwolf Pro HDDs tuned for NAS use. That's right, sixteen whole terabytes in a single 3.5-inch rectangular slab of metal. Place four of these monsters in a RAID-5 NAS and you've got over 43TB of usable storage once the array is formatted.

If you're familiar with the Ironwolf family of HDDs, there's not a lot new here except the big stonking 16TB of capacity. But for those new to the NAS HDD game, let's dig in to what makes these drives suitable for a NAS over other HDDs.

The main benefit of a NAS specific drive is that they're designed with 24/7 operation in mind, particularly when multiple drives are shoved in a small enclosure where things like heat and vibration have

more of an impact on drive longevity than in a desktop PC. By using a dedicated NAS HDD in your NAS, the risk of a HDD dying is reduced.

While the Ironwolf and Ironwolf Pro have identical performance and share a common base of NAS specific benefits like rotational velocity sensors, improved error recovery controls, advanced power management, RAID optimised firmware and 7200RPM spindle speeds, there are some differences to justify the extra cost of the Pro. Increased durability is the main reason to get an Ironwolf Pro. They're rated for 300TB of data writes a year versus 180TB and have a mean time before failure (MTBF) of 1.2 million hours versus one million for the non-Pro Ironwolf. When moving around large files daily (4K video editors, take note), that 180TB of data writes a year isn't a high as

it sounds.

Will you be placing these drives in a NAS with more than 8-bays? Go with the Ironwolf Pro. When there's more than eight drives in a single NAS, the subtle vibrations from all those drives tightly packed into the NAS enclosure are enough to disturb the even more tightly packed spindles inside each high capacity drive. When the rotating spindle is constantly disturbed, performance is impacted and the chances of data corruption increases. Seagate has added superior vibration resistance to the Ironwolf Pro, which is why it's rated for use in enclosures up to 24-bays.

The Ironwolf Pro also comes with a five-year warranty (three-years is standard on the non-Pro Ironwolf) and includes two years free access to Seagate's Rescue Data Recovery Service. If your

Ironwolf Pro HDD dies on you, simply send it back to Seagate and the company will recover all the data it can off it for free.

Top capacity HDDs have never been cheap and that remains the case with the standard Ironwolf going for \$959 and the Pro for \$1,059. With so much data on a single disk, it's probably worth spending the extra \$100 and getting the Ironwolf Pro, because it comes with a longer warranty and free data rescue. These bonuses alone could be an absolute butt-saver when 16TB of data is involved. ■ Anthony Agius

## Verdict

When you need all the data you can get in a single drive, accept no substitute.







PHONE

\$279 | [ALCATELMOBILE.COM](http://ALCATELMOBILE.COM)

# Alcatel 3 (2019)

Flagship features on a shoestring.

**T**he new Alcatel 3 (2019) is a key device for the firm, as it's a core mid-range offering which should appeal to value hunters. Alcatel has made sure the handset is well equipped, with a 5.94-inch display, octa-core processor, 64GB of storage, a fingerprint scanner, face unlock and even AR emoji. These are features usually seen in high-end phones, but Alcatel is pushing ahead with offering more than you'd expect from its affordable range.

The first time you see the Alcatel 3 you'd be forgiven for thinking its price tag is double – if not more – than what is being asked for. The rounded design with a large screen dominating the front of the phone is only interrupted by a small teardrop style notch at the top of display. On the rear a glossy two-tone casing provides a finish akin to pricier Honor and Huawei

handsets. There are two color options, black fading to blue and purple fading to blue, and on the top there's a headphone jack. Rejoice. Pick up the Alcatel 3 and you'll quickly realise this isn't a flagship device, as the body of the phone is shiny polycarbonate rather than glass or metal.

Still, it sits nicely in the hand and feels solid, although it doesn't offer up much in the way of grip. The power and volume keys on the right are easy to reach, as is the fingerprint scanner on the rear. The 5.94-inch display is tall, with a 19.5:9 aspect ratio and features a HD+ (720p) resolution. On close inspection you can see the lack of clarity in the display, but this is to be expected at the price. It's still perfectly usable with clear, bright images and text. The notch, the size of the single front facing camera, is centrally located in the notification bar and doesn't really get in the way.

The Alcatel 3 (2019) packs a dual camera setup on the rear, with the main 13MP sensor sitting above a 2MP depth sensing lens. This provides a portrait mode background blur feature within the camera, and during our time with the phone we found it to be serviceable. It's not going to take award winning snaps, but the camera is good enough at this price point.

A more surprising addition is AR emoji, allowing you to control the facial expressions of on-screen characters. There are three animals and two humans to pick from and the face tracking works surprisingly well for a budget device.

Another feature packed into the new Alcatel 3 camera is automatic scene recognition. It can detect 21 different scenes and adjust settings to give you the best shot for your situation without you even knowing.

The Alcatel 3 does run an older version of Android though – 8 Oreo – and it's not clear when (if at all) it will get an upgrade to Pie. Rounding off the Alcatel 3 is a sizable 3,500mAh battery, although there's no fast charging support.

The Alcatel 3 (2019) could be one of the budget hits of 2019 with a great balance of features, power and style for a price that is hugely attractive. It can handle relatively demanding apps and games, though the camera is passable at best, but with AR emoji, face unlock, a fingerprint scanner and large display there's little not to like.

■ John McCann

## Verdict

A lot to like, though if you seek high performance look elsewhere.





# software

» APPS FOR ALL YOUR PLATFORMS



## Windows SOFTWARE

### GOG Galaxy 2.0

CD Projekt's solution to multiple launchers for PC gamers is off to a promising start.

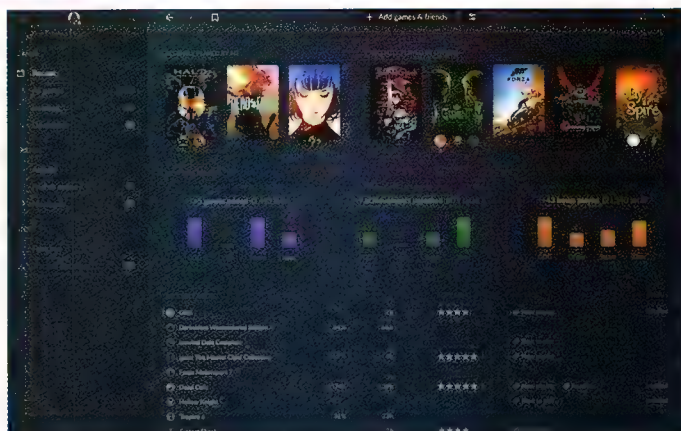
FREE | [WWW.GOGALAXY.COM/EN/](http://WWW.GOGALAXY.COM/EN/)



A decade ago there was really only one PC game storefront and launcher platform: Steam. Sure, Blizzard's Battle.net was around, but Valve had an incredible hold on the digital market

through Steam. More recently however, publishers have begun building their own storefronts to avoid splitting the revenue with Valve. Between Uplay, the Epic Games Store, Origin, Battle.net, Xbox, the Windows Store and the Bethesda Launcher there's a lot of PC games platforms and it can be awfully confusing for users.

Version 2.0 of the GOG Galaxy PC game platform is currently in closed beta but you can clearly see the direction CD Projekt is looking to take. It wants to fill the gap of a new unified games launcher. Your GOG account is a base, which you then build upon by connecting all your other accounts, be it Steam, Origin or Xbox. You'll be able to import all your games, launch them from within GOG Galaxy, sync achievements and game time, and even chat with friends or see when they're online. That's the goal



anyway. At the time of writing, only Xbox and GOG are "officially supported" integrations; the rest are provided and maintained by the community.

GOG Galaxy 2.0 attempts to match your games to its database of titles, much like Plex does with music, video and other media. It is usually accurate but you have the option to tag stuff or change out images and icons if you want to micromanage everything. For now, friends are not imported, nor can you chat cross-platform, but this is something CD Projekt has hinted at enabling before the new launcher makes it out of the beta phase.

Unfortunately, it's not yet at a point where you can just uninstall Steam, Uplay, Origin, Epic, and Unity. You'll need to keep them all to purchase exclusive games going forward and GOG Galaxy 2.0 will need to continually connect and pull game info from them, but after the initial setup, it's not a bad collective launcher and gaming hub.

Rich Edmonds

### DaVinci Resolve 16 Beta 4

What does the latest update bring to the table?

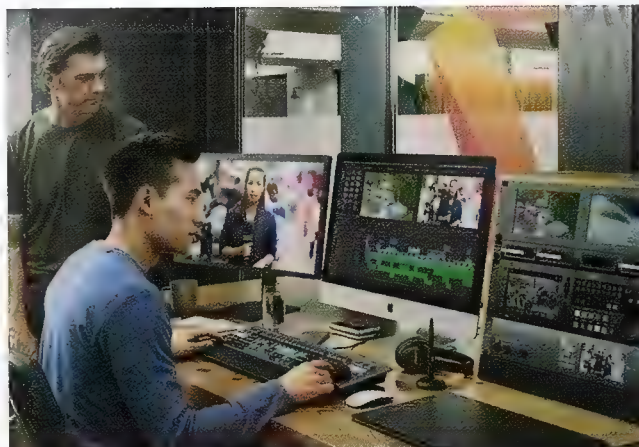


US\$299 | [WWW.BLACKMAGICDESIGN.COM/PRODUCTS/DAVINCIREOLVE/](http://WWW.BLACKMAGICDESIGN.COM/PRODUCTS/DAVINCIREOLVE/)

When we last looked at DaVinci Resolve back in November 2018, we were thoroughly impressed, not only by the vast array of features present, but also by the price. You can use Resolve for free or pay a one-off fee of \$299 to get a perpetual license for the Mac, Windows or Linux version of Resolve Studio. And by perpetual, the folks at Blackmagic state that all future versions – even major revisions – will be free to all existing licence owners.

One of the main additions is the introduction of the Cut Page. Not everyone needs all the editing tools to hand when they're doing an initial cut, so Cut Page simplifies the interface, allowing you to add clips into a project quickly and start making design decisions straight away.

You can finally upload your project directly to social media, stabilise clip colour from the Edit or Cut pages and Resolve now has full integration into Frame IO allowing you to upload timelines to cloud storage systems. ■ Steve Paris





## Mac » APPS



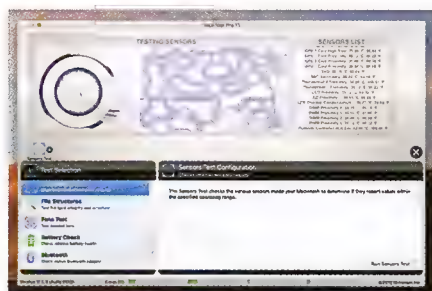
# TechTool Pro 11

Hardware diagnostics and disk repair.

US\$127.99 (UPGRADES FROM US\$9.99) | MICROMAT.COM | NEEDS OS X 10.10 OR LATER

TechTool Pro has really been the only comprehensive toolkit for diagnosing hardware problems over the last 30 years. And the latest version (we've tested 11.0.3 here) keeps pace with recent features like T2 chips, Apple's new file system, and Mojave's privacy protection. It's even notarised for compatibility with macOS 10.15.

When you first open it, you'll be prompted to give it Full Disk Access



Hardware tests are comprehensive, and it will find more sensors in your Mac than you ever thought existed.

in your Security & Privacy pane. This adds the four necessary items, provided you follow its instructions.

Before running any tests, even its Check Computer, study its 35,000-word manual and set a configuration which you won't regret later. By default, it will test volume structures on an internal boot SSD, which makes your Mac unresponsive: after 20 minutes with the clock and Finder frozen, we forced our iMac Pro to shut down as the only way out; it's impossible to tell whether it's still testing or has ground to a halt.

### MIGHTY MAC SAVER

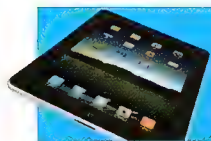
In addition to extending existing tests to cover Mojave and the latest version of APFS, version 11 adds the repair of permissions in your Home folder. First recommended by Apple in Sierra, this remains a valuable trick for fixing wide-ranging problems such as preference files that don't stick, but can take several hours.

There are still enforced gaps in some of its tools. It can verify and repair volumes in HFS+, APFS, FAT32 and ExFat, but defragmentation, much of its data recovery suite, and some storage protection can't work on SSDs or boot volumes. This is mitigated by two invaluable features. eDrive volumes are customised Recovery partitions in which you can include TechTool Pro and other tools. Protogo complements those by building bespoke startup disks such as USB thumb drives for those little emergencies.

While specialist tools can give more detail on storage, there's hardly any Mac hardware that TechTool Pro can't inspect and test. Its coverage of the many sensors in your Mac is superb, and it'll even do battery checks on tethered iOS devices.

This isn't for the casual user, but at the right time, in the right hands, it's a Mac saver. ■ Howard Oakley





# App Store » iOS APPS

## Cardhop

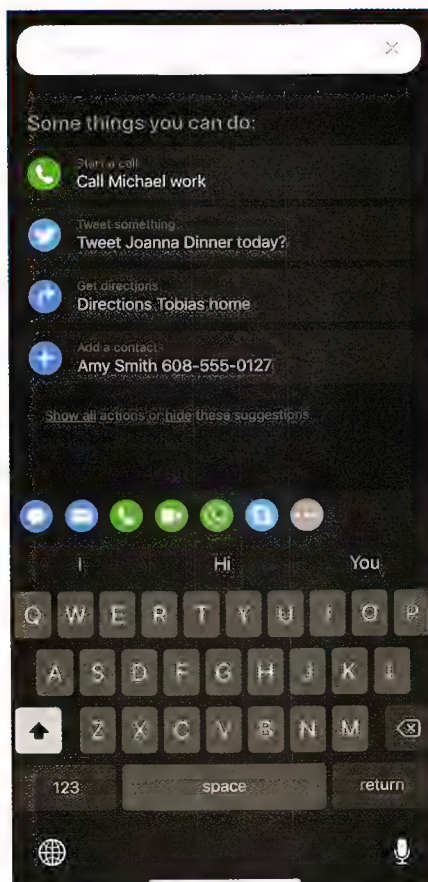
Upgrade your contacts.

\$5.99 | FLEXIBITS.COM  
NEEDS IOS 12

Cardhop brings natural language to your contacts. Want to add a new email address to a contact? Start typing their name, then the email address. Struggling to read a contact's info? Type 'large' followed by their name to have their details displayed in an increased font size.

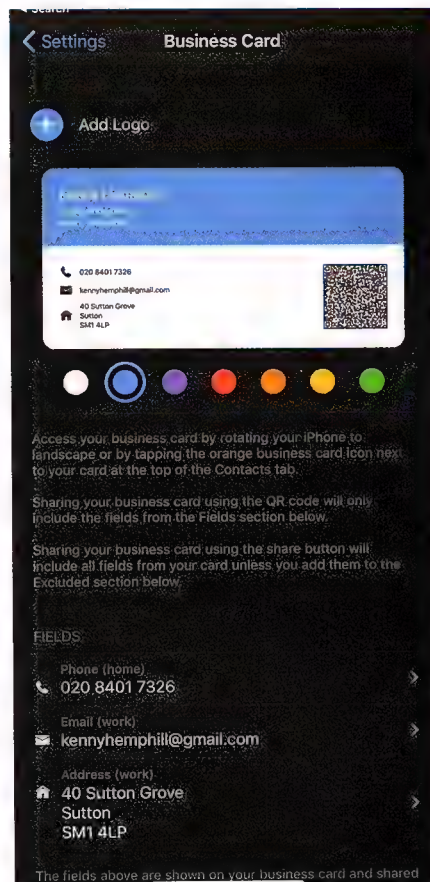
You can use natural language with a variety of actions, such as 'Directions' to get directions to a contact's address. Or you can visit a contact's web page by typing 'Website' followed by their name (if you have a site address stored for them). Most actions require you to tap an icon after typing the trigger phrase.

Cardhop lets you specify which browser you use, which email client it opens, and which maps app you use. You can also choose which Quick Action buttons appear on the keyboard, whether they're shown on a contact's card, and whether swiping over a contact in the list reveals Quick Actions. There are also a number of handy pre-built



Siri Shortcuts.

Some contacts in the Recents list were suggestions the app made that were never selected, which isn't



always useful. Otherwise, this is a terrific contacts manager.  
Kenny Hemphill

## Rolando: Royal Edition

Back to basics with an iOS classic.

\$4.49 | HANDCIRCUS.COM  
NEEDS IOS 9 OR LATERR

Back in 2008, this platform-based puzzle game showed off what iPhones could do with its colourful aesthetics, chilled-out tunes, and (at the time) unusual touchscreen and accelerometer controls.

This version brings a graphical upgrade to '2.5D'; the world is rendered using 3D objects, with the action taking place in a 2D plane. The look is charmingly simple, and the atmosphere enhanced by the feel-good, chilled-out soundtrack.

The first levels teach you how to move the characters. Mostly it's by tilting your device left or right to roll them across the landscape, using their bodies to push things, and flicking to jump. Certain objects, like turnstiles and



lifts, require direct manipulation, though. Characters roll responsively, though perhaps a little too keenly. Newcomers to iOS gaming, particularly young minds, are the most likely to be entranced.

You can enjoy watching your kid playing it, and using it to learn about precise control, without them getting angry at unfair challenges.  
Alan Stonebridge





Google Play » ANDROID

# DoodleLens

Drawn to life.

\$2.99 | KEVAID.COM



DoodleLens is a great idea – it's an AR app that lets you copy doodles you've drawn into the 'real world', then make videos of your creation existing in whatever space you insert it into. In practice, it's not quite as cool as it looks in the video that plays when you start the app up, which makes it seem as though just about anything is possible. It's pretty finicky with what it picks up, and I found that often it would read my pictures as a giant black space that took up most of the screen. I got my best results from doodling onto Microsoft Paint, with hand-drawn doodles often not copying across properly, and the app really struggles with anything more complex than a very simple drawing. Once you've got a doodle up, though, it's some good light fun, although maybe not as magical as you might imagine. You can potentially 'animate' your doodles for more advanced videos, but don't expect anything too flash or seamless.



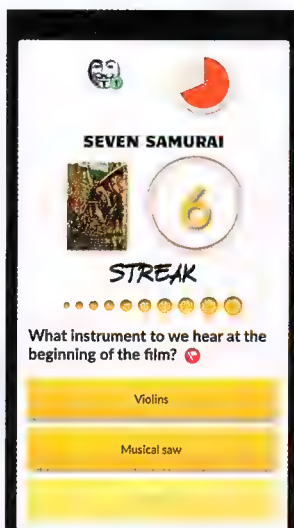
## Qurator

...then name his last three albums.

FREE | [HTTP://QURATOR.CO/](http://qurator.co/)



Qurator has launched with a lofty goal – to weed out review bombers and ensure integrity in user ratings for movies. To do this, it asks you to succeed at a quiz about the movie before you can assign a rating, to prove that they watched it and paid attention. The quizzes are generally very plot-specific, asking you questions that you really do need to have seen the movie to answer, and you'll need a score above 50 to rate the movie. So, what movies currently show up in the front page top 10 (which is seemingly based on how many people are rating the films)? *Back to the Future*, *Spider-Man 2*, *The Lion King*, *Terminator*... the closest things to curveballs are *Fiddler on the Roof* and *Coming to America*, so don't expect hot recommendations. The front page is barebones beyond this. You can search individual movies to see their ratings, but a lot of movies haven't been added yet, presumably because writing quizzes for them takes a lot of work. Qurator's a fun idea, but it's probably not going to revolutionise user ratings.



## Time Immersive

Not app of the year yet.

FREE | TIME.COM



Time Immersive (as in, *Time* magazine) is presumably going to grow over time. But right now, unless you have a copy of the magazine on-hand and can test out some of the features it promises (we don't), there's not a lot to it. There's one AR project on there as of writing, though, and if it's an indicator of what we'll see on Time Immersive in the future then the app is worth having. There's a short interactive AR recreation of the Apollo 11 moon landing on there right now, letting you watch it from outside on the recreated moon's surface or from inside the module, while authentic audio from the moment plays (when the commentary track quietsens down). Afterwards, you can walk on the moon for a bit and have a look around. It's not perfect, but it's still a strong reminder of the promises of AR, and VR experiences are coming in the future too. Download the app and set up a push notification for future experiences, because they'll clearly have the budget to create some cool stuff. ■ James O'Connor







## Zorin OS 15 Core

Any Ubuntu-based distro has to pull something special to get into the good books of Mayank Sharma. Has he found a unicorn, or a one-trick pony?

FREE | [HTTPS://ZORINOS.COM](https://zorinos.com)

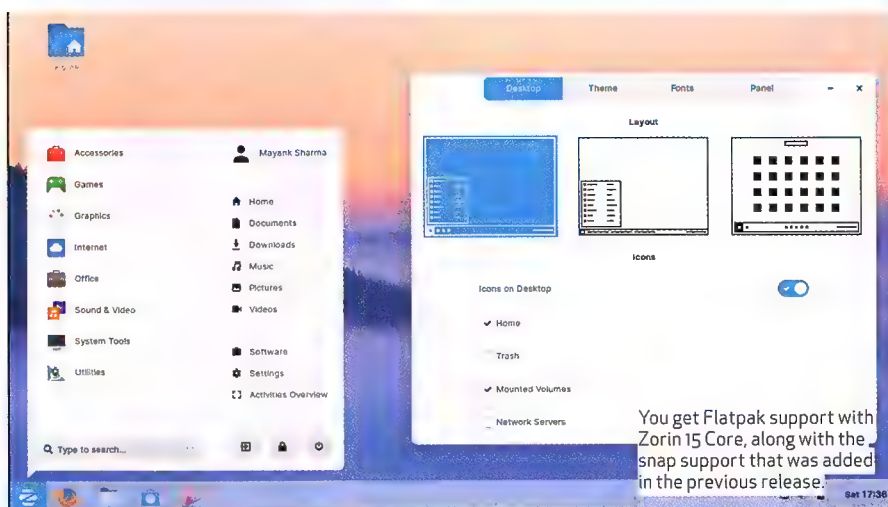
**W**e've seen the likes of Zorin OS before, in Pinguy OS and elementary OS. These are distros with tweaked desktops that take advantage of their Ubuntu base to ease new users into the Linux desktop. Zorin does the exact same thing, but the way it goes about it is what sets it apart from others.

The newest v15 release is based on the latest update of the Ubuntu 18.04 LTS release. The distro's goal is to package the goodness offered by Ubuntu into a system that's made accessible thanks to its "familiar interface". For this the developers have mutated the Gnome 3 desktop to sport a single panel along the bottom of the screen, which is very reminiscent of Windows' taskbar. It completes the look with a traditional Applications menu on the left, followed by a few app launchers, the taskbar area, a system tray and a notification area on the other end. Even the layout and behaviour of the custom Applications menu is Zorin's attempt to ape the proprietary OS.

Previously we've praised Zorin for mimicking other OSes via its layout-switching app that shape-shifts the desktop. It's now called Zorin Appearance and in the Core edition only really offers a touch-friendly alternative to the default layout, which in essence replaces the Applications menu with the Gnome 3 All Applications view. There is another layout called Windows Classic, which is just a slight tweak of the default layout in that it doesn't group open apps in the panel – and that's about it.

### DEMO RELEASE

We can understand why the developers would want to restrict the macOS-like layout to the paid-for Ultimate Edition. But it makes no sense not to make the standard Gnome 3 and the Ubuntu layouts available: would you really want to pay for these layouts when you can get them for free elsewhere? Oh, and in case you are



"Would you really want to pay for these layouts when you can get them for free elsewhere?"

looking for the Gnome Activities Overview, it's tucked into the Application menu, which makes the omission of the standard layouts seem even more bizarre.

The Zorin Appearance app can do several other tricks besides switching layouts. One touted highlight is its ability to automatically adapt the background to the time of the day, a fancy way of saying it switches between light and a dark theme. You will find a good number of customisation options in the app to tweak the behaviour and look of the various elements in the Zorin panel.

Another highlight is the Zorin Connect app that builds on the work of GSConnect and KDE Connect to wirelessly meld mobile devices with computers, in order to share content such as notifications, files and more. Zorin has a leg-up on its peers here since it is the only one that currently includes this functionality with the default install.

There's not much to write home about with the apps bundled with the Core edition – it's got everything you'd expect from a desktop distro. In what we feel is the distro's attempt to nudge more Windows expats towards its paid editions, Zorin has removed Wine and its PlayOnLinux frontend that were some of the highlights of the previous Core releases. Even the freely available Steam client is missing from the Games menu of the Core edition, which is a real shame.

All things considered, the pre-installed Zorin Connect is the only real pull that this distro has to lure first-timers away from the competition. People coming for familiarity and continuity in user experience will still be better served with the paid editions, and Core does its job of convincing them to reach for their wallets ■





# THE SMART HOME STARTER KIT

From voice controls to smart cameras and thermostats that learn your routine, these are the products to look out for as you build your 21st century home.

No home today is complete without a smattering of technology. Where once that might have meant a record player you weren't allowed to touch because the stylus was delicate, or a television built into a cabinet that took a team of horses to transport, these days home tech is small, convenient, and connected.

It's the connectivity that makes modern home gadgets stand out. Now that we fill our houses with Wi-Fi, anything can connect from anywhere without having to install cabling, which means devices such as the Amazon Echo can talk to Philips Hue lightbulbs, turning them on and off at a command.

Your doorbell can get in on the act too, plugging into your network to provide HD video of whoever's outside,

and functioning as a motion detector too, so you see everyone who's lurking.

Then there's music streaming – many smart devices act as speakers, and you can connect them to Bluetooth speakers too, wirelessly beaming your tunes into any room. Turn plug sockets off with a tap of your keyboard. Get a notification on your phone when the kettle's boiled. Lower your blinds and turn up the heating with a word. Even talk to your dishwasher.

It's an exciting time to be building a smart home, as for the first time different technologies from different manufacturers are coming together to create something new: a networked home that responds to its owner's wishes. Here's a taster of the kit out there.



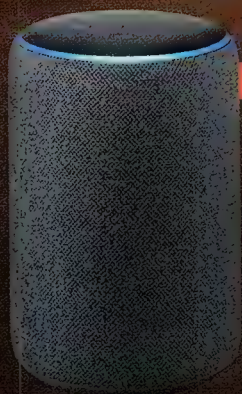
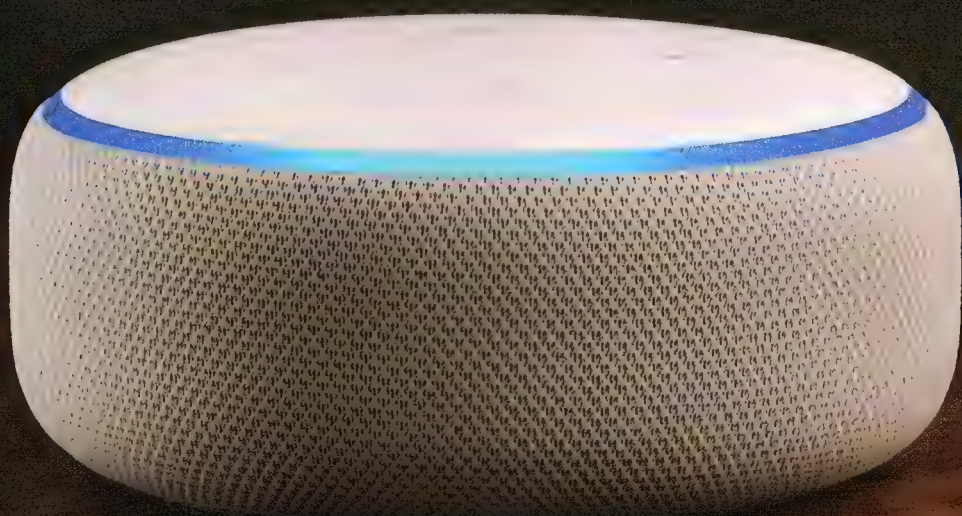
# Amazon Echo Dot

The small speaker that unlocks a world of smart options.

The Echo Dot is the cheapest Alexa device that doesn't need any other equipment to work – it's got speakers, microphone and wireless connectivity all in one small puck. The full power of Alexa is here, so you can ask your Echo Dot to control loads of the other devices you'll find in this guide, as well as being able to tell it to play music from a host of streaming services, asking it questions, and adding more using Alexa 'Skills' that you can install. It has

four far-field microphones that should be able to pick up your voice from way across the room, and filter out ambient noise. The sound quality from such a small device obviously isn't amazing, but it can be connected to bigger speakers by cable or Bluetooth. Don't pay the RRP for one, though: it's pretty regularly down to roughly \$45 in sales.

**\$74, [amazon.com.au](https://www.amazon.com.au)**



IF YOU WANT TO SPEND MORE...

## Amazon Echo Plus

If you want to get an Alexa device with more smart home features to it, the Plus is the best option. Like the Echo Dot, you've got the full power of Alexa, though with beefier Dolby-tuned speakers. But the main draw is the

built-in smart home control hub, which can connect to many smart home devices directly, so you don't need a different hub for them all.

**\$149, [amazon.com.au](https://www.amazon.com.au)**



# Google Home Mini

"Okay Google, make my life loads better".

This is a complete Google Assistant device in a teeny, tiny package – it's the Google equivalent to the Echo Dot, put simply, so it's microphones and speakers all in one box, and it's easy to tuck away in a corner. It comes in funkier colours than the Dot, and has a nice dome shape with a fabric finish. Google Assistant has lots of smart home control capabilities built-in, and is unbeatably good if you want to ask knowledge questions – not just about facts, but also to translate something into another

language, or to get personalised news and other information useful for your day, such as weather, traffic and finance. There are built-in games that families can play, too. It supports lots of music services, though again its speaker quality is limited due to its small size. It has Bluetooth support for playing to other speakers, and Chromecast multi-room audio streaming. Again, look to pay about \$45. \$79, [store.google.com/au](https://store.google.com/au)



IF YOU WANT TO SPEND MORE

## Google Home

The next size up in Google's Home range does all the same things as the Home Mini, but with bigger and beefier sound. It comes in some pretty funky finishes on its bottom half, ranging from matt fabrics to metallic plastic, all with a striking white top half. If you want

seriously good sound, though, take a look at the Google Home Max, which is a beautiful-sounding speaker that adapts its sound to the acoustics in your room, but costs \$399 for the privilege (and it's huge). \$149, [store.google.com /au](https://store.google.com/au)



# Ring Video Doorbell

Somebody's at the door  
– find out who, wherever you are.

Video doorbells are huge in 2019 – every company is getting into the game. The Ring doorbell is really useful not only for letting you know whether it'll be worth going to the door before you get up (great if you're ill, or have mobility issues), but also for security, since it keeps an eye on the front of your house using motion detection and night vision built into its camera. Plus, you can also avoid opening the door to strangers (though you can still speak to them using the Ring's built-in speaker and microphone). As an added bonus, they're great if you're down the garden where you might not hear the doorbell, since you'll get a notification on your phone when someone presses it. You can even direct couriers where to leave a package if they arrive when you're not there, because you can connect to it from anywhere that you have internet access. This model needs to be wired in, which is easy enough to do yourself if you already have the connections in place.  
\$149, [ring.com](http://ring.com)



IF YOU WANT TO SPEND MORE...

## Ring Video Doorbell 2

The upgraded version of the Ring adds the option for it to be powered by a battery pack, so no need for it to be wired in. It also has a higher-definition 1080p camera, plus the ability to set the motion detection to only trigger if movement is spotted in specific areas of its view, so you could ignore the road or next door's pathway, if you get lots of false positives from people going near your house but not right up to it.

\$319, [ring.com](http://ring.com)







# Swann Wire-Free Security Camera

This'll do everything except peer round corners.

Made to be a multi-camera security system that covers your whole house, these units are totally wireless, meaning no cable for their video footage, and no power cords. They have rechargeable batteries built in that last three or four weeks, and a magnetic mounting makes them easy to pop on and off when you need to charge. You can buy as many as you need to cover all your house's danger spots (inside and out, thanks to weatherproofing), and view them all from a single app, which

will notify you when it spots something you need to know. They have heat and motion sensing built in, as well as night vision. They stream footage to the cloud over Wi-Fi, but you can also add a microSD card to each unit, so that your footage safely exists in two places. They work with Google Assistant and Alexa, too.

*\$269 per camera, [swann.com/au](http://swann.com/au)*

## IF YOU WANT TO SPEND MORE...

### Arlo Ultra

The ultimate in image quality for your smart home security. Like the Swann cameras, this uses totally wireless cams that can be mounted anywhere to keep an eye on things. And what an eye – the 4K HDR sensor in each unit means amazingly clear footage when you need

it. There are tons of smarts too, powered by a central hub, which the cameras wireless connect to. But it's hugely expensive: the price below gets you just one camera and the hub.

*From \$379, [arlo.com/au](http://arlo.com/au)*







# Ikea Trådfri

Light up your life with this range of bulbs, light panels and controls.

Ikea's smart lights are almost comedically cheap, but really useful in their flexibility. You'll need the gateway, which connects to your router and controls the bulbs, but that's just \$39. Then you can choose whatever bulbs you need, starting from \$19 – there are options for small and larger fittings, as well as spotlights (though, this being Ikea, there are no bayonet-ended bulbs). Even cooler, there are larger light panels available, so you can turn your wardrobe door into a

big smart light if you feel like it. When you've got the bulbs and gateway, you can set the brightness of the lights, play with their colour tone, choose their schedule, use voice controls to activate them, and group them so it's easy to set a mood or turn everything on and off together. As an added bonus, the range includes dimmer controls for manual adjustments, and motion sensors for automatic lighting. From \$60 (gateway+bulb), [ikea.com/au](http://ikea.com/au)

If you want to spend more

## Philips Hue

The best range of connected lights on the market due to sheer variety (and that they're excellent quality). You'll need a Hue Bridge to control the bulbs (available in good-value starter packs from \$139 online), and then you can add any kind of bulb you need – they're a little more expensive than Ikea's, but there are bayonet options, LED light strips, outdoor lights of various kinds, and loads more. There are also multi-colour bulbs, so you can really set a mood for those special evenings. \$139 (Starter Kit), [meethue.com](http://meethue.com)





# LIFX Tile

Personalise your lighting with this clever decor system.

Like the Philips Hue, LIFX offers a large range of coloured and white LED smart bulbs, and like Hue, they can very easily be integrated into your smart home network. It's particularly delightful to ask your AI of choice to change the colours and like magic, it just happens. The Tile system from LIFX is something a level higher. These flat panels each have 64 light zones that can be customised – or just run each tile as a single colour, and you've got 64 million to choose from. They can also animate and the app has many built in effects, including a party mode music visualisation mode. It's all quite sci-fi once you have it set up, which is easy thanks to the light weight of each Tile and that they come with a simple 3M Command Hook attachment method. Arrange them in any shape you like to really add zing to your home. Tile supports Apple HomeKit, Amazon Alexa, Google Assistant and Microsoft Cortana. From \$399, [lifx.com.au](http://lifx.com.au)

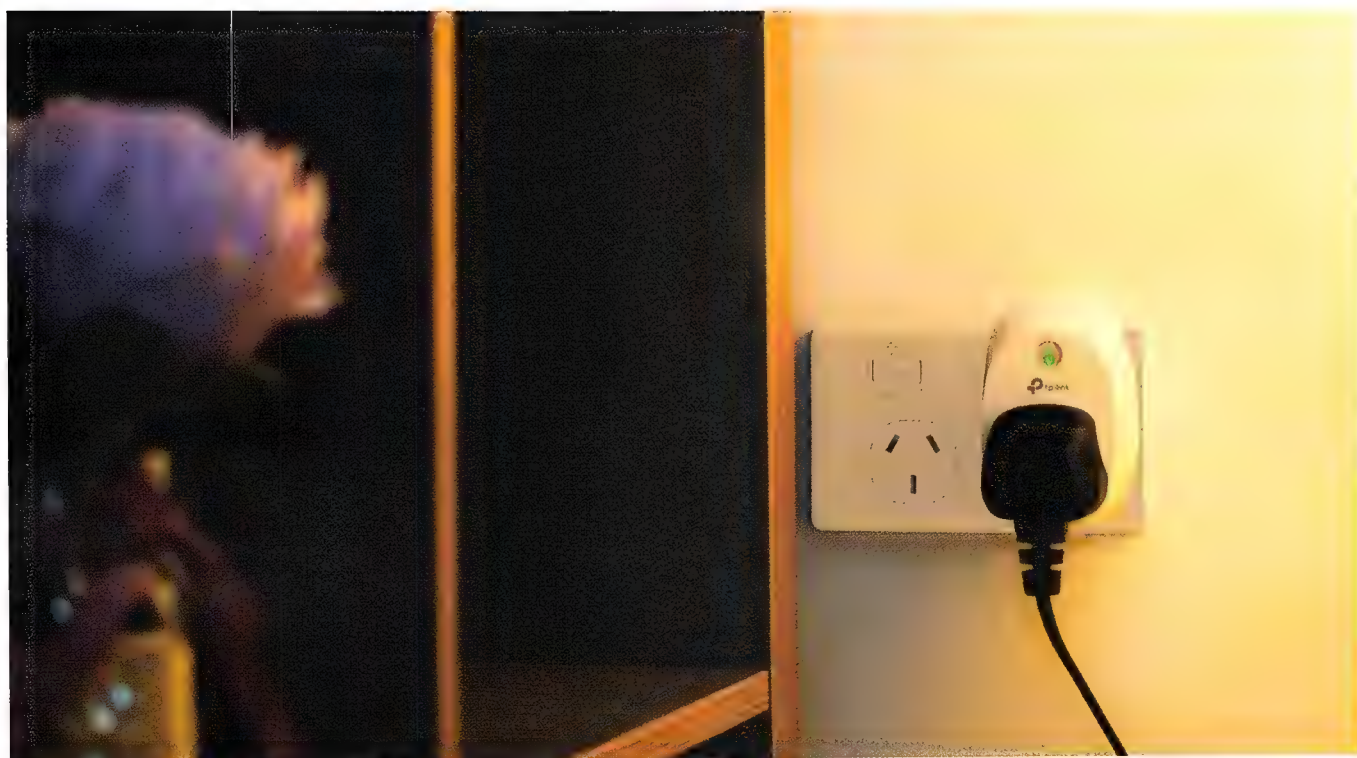
## Logitech Circle 2

This camera is available in many guises: a simple indoor version, or one with a rechargeable battery so that it's totally wireless, or weatherproof so it'll survive outdoors, and even one that plugs directly into a socket with no cable. It has a 180-degree field of view with night

vision, and smart alerts mean that you don't get bugged for every bit of movement – it'll only warn you when it appears to be a person, say. It also has fun features like a 'day brief' overview of the day.  
\$222, [logitech.com](http://logitech.com)







# TP-Link Kasa Smart Wi-Fi Plug HS100

Power can be yours with a smart plug – don't let it go to your head.

Smart plugs are perhaps the perfect place to start building a smart home, since they can turn anything into a connected gadget. Make your lamp activate on a timer without a smart bulb; turn your fan heater on remotely to warm up a room before you go in; activate your slow cooker at a set time... if it plugs in, you can control it. It's easy to set up all that in this plug using its app – you can trigger things on and off at will,

set schedules, or use geolocation to make things happen automatically when you're away from the house, such as turning switches off to save power. There's also voice control via Google Assistant and Alexa, so you can just ask for things to come on and off at will. There's no hub or anything needed with this. \$29, [tp-link.com/au](http://tp-link.com/au)

IF YOU WANT TO SPEND MORE...

## TP-Link Kasa Smart Wi-Fi Plug with Energy Monitoring HS110

For the next level of smart plugging, why not try the big brother of the product above? Available for around \$35 online, it has all the same great control functions as the cheaper option, including voice assistant control, but it will also monitor how much energy whatever's plugged into it is using. You can see what's being used in real-time, and act on it, or view historical data to get an idea of much energy has been used at certain times or on certain days. It's great for getting a handle on your household's overall power consumption. \$45, [tp-link.com/au](http://tp-link.com/au)







# Netatmo Starck Thermostat

Maintain the perfect temperature while saving the planet.

Smart thermostats are one of the best buys you can make, because they're convenient, they save you money, and they help you go greener. The ability to control your heating schedule more finely saves you money on its own, but the added smarts of the Auto-Adapt feature mean it comes on earlier on really cold days, so you reach the temperature you want at the right time. Equally, it takes your insulation into account so the house doesn't overheat. It works with

Alexa, Google Assistant and Apple HomeKit, so you can tell any major assistant what you want the heating to do, or you can use the app. It's a looker, designed by Philippe Starck, and you can expand its clever control by adding smart radiator valves. You can find it for under \$300 online, making it the cheapest really clever thermostat.

*\$349, [netatmo.com](http://netatmo.com)*

IF YOU WANT TO SPEND MORE...

## Tado Smart Thermostat V3+

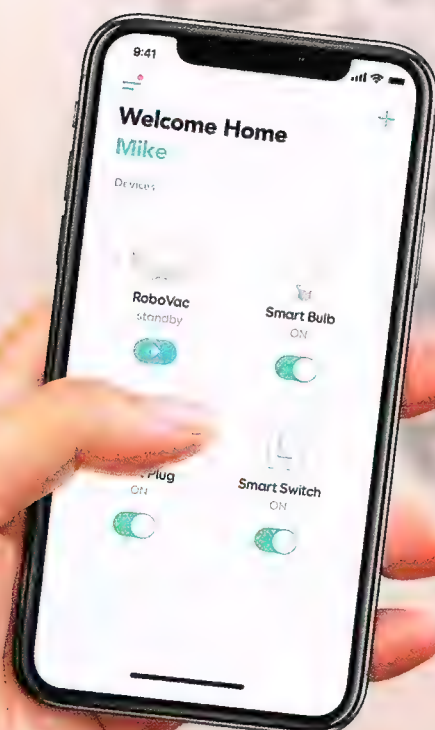
One of the best smart thermostats overall, this has an even sleeker design, and boasts tons of smarts, including the ability to learn the layout of your home and its heat capacity, along with geofencing so it knows when it needs to come on for you. Like the

Netatmo, there are optional smart radiator valve add-ons, which let you control how the heating affects each room individually. You should be able to find its starter kit for around \$150 online.

*\$199, [tado.com/au](http://tado.com/au)*







# Eufy RoboVac 15C

As relentless as the Terminator, but only against dirty floors.

This robot vacuum cleaner is one of the cheapest connected models around, but packs in plenty of smarts and strong cleaning capability. The built-in Wi-Fi connection means that it works with both an app and Alexa voice control. The app enables you to take manual control of cleaning, or to set schedules for it to run automatically, and it will send you notifications when you need to know something. It also comes with a physical remote, in case you need one. The unit itself

uses infrared technology to avoid collisions, and has drop sensors to avoid tumbling down the stairs. Maybe the most useful part is the BoostIQ tech, which increases suction on surfaces that require it, such as carpets. With roughly a 100-minute runtime (depending on suction strength), it can get round a whole house easily enough on a charge, too. Plus it will automatically head back and recharge itself. *\$814, eufylife.com*

IF YOU WANT TO SPEND MORE...

## Neato Botvac D7

The smartest robo vac around adds a host of extra app-based options to the kind of stuff offered by the Eufy. It uses lasers to map your house as it goes around cleaning, which not only helps it find its way precisely, but also means you can see an

accurate map of where it has cleaned, and where any obstacles were. You can also use this map to set 'no-go' zones, to avoid areas where it might get stuck, or around delicate objects. *\$2,500, neatorobotics.com*





# CLOUD GAMING DREAM OR NIGHTMARE?

As Google announces the Stadia, Christian Guyton investigates the past and future of cloud gaming.

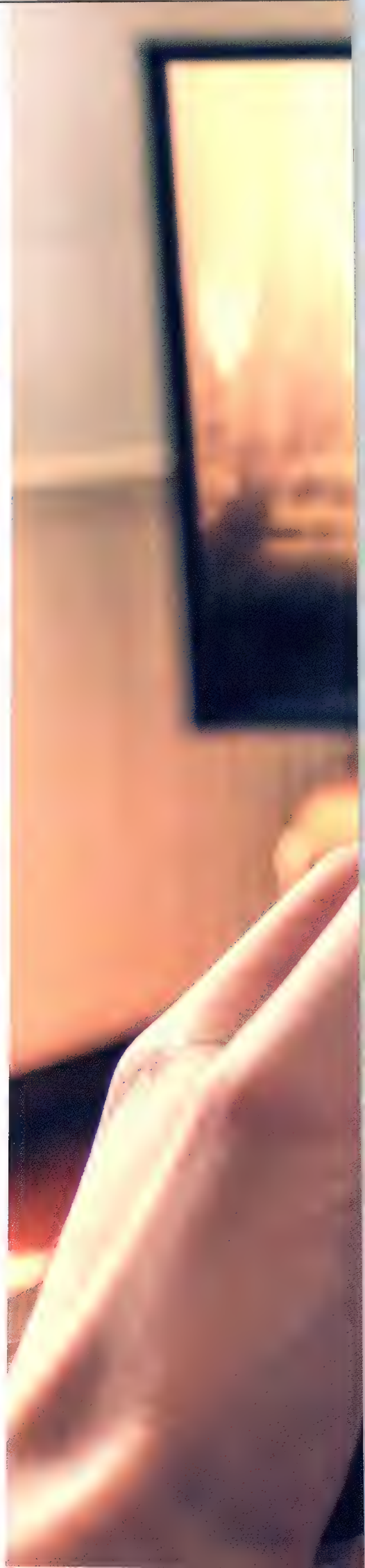
**S**treaming is a funny thing. For movies and TV, it's no surprise that it's taken off; services such as Netflix and Amazon Prime Video offer unlimited on-screen entertainment at subscription premiums, demanding only 5MB/s to deliver HD-quality movies to our televisions, office computers, and cell phones. Music is even less demanding – just ask Spotify to quote you its crisp US\$1.5 billion revenue from the last quarter of 2018. But gaming? That's a whole different ballpark. In fact, we're not even sure if it's the same sport.

Issues that make zero difference to the streaming of movies or music become huge complications when games enter the fray. Frame rate? Latency? Load times? All big concerns. Nobody cares (or even notices, really) if there's two-tenths of a second between pressing the pause button on your Netflix Original show and the action stopping, but such a delay could be the difference between victory and crushing defeat in a high-stakes match in *Call of Duty*. Games – even single-player ones – chew up bandwidth like nothing else when played via streaming, too; 5MB/s isn't even close

to enough for anything remotely demanding.

Many have tried and failed to deliver the perhaps-mythical 'Netflix for games' often discussed by developers and journalists alike, with each doomed attempt leading to a slew of articles touting streaming-based gaming services as a dead medium. It's a tired cycle that has been struggling onward since the early 2000s, each new attempt drawing huge excitement before crashing and burning to a painful halt.

Enter Google, as it always does, with its own hot take on the latest fad. Announced at the 2019 Game Developers Conference in San Francisco, the Google Stadia promises to be the Next Big Thing in the game-streaming world. With multiplatform support, 4K and 60fps capability, and an evolving cloud-based infrastructure, Stadia is perhaps the most ambitious project of this type to date – but will it succeed? Only time will tell, but for now, we can take a deeper look at the history of streaming-based gaming platforms, and what directions they might take in the future.









Stadia is far from the first of its kind. The notion of streaming-based gaming platforms has been around for close to two decades, ever since YouTube exploded in popularity in the mid-noughties. To be able to play games without ever having to purchase and download them does sound attractive, but the execution has always been flawed. The theoreticals were first demonstrated by G-cluster at the 2000 Electronics Entertainment Expo, with Crytek investigating the possibilities a few years later before shelving the idea due to concerns about consumer internet speeds.

The first big hitter to take on the challenge of a streaming-only game platform was OnLive, a Californian company that specialized in cloud computing. Its flagship product was its proprietary cloud gaming service of the same name, first announced at GDC 2009, exactly one decade before Google decided to take a shot at the crown at the same event.

OnLive managed to gather some real traction in 2011, capable of operating on multiple versions of Windows and MacOS X, as well as Android smartphones, tablets, and even some smart TVs. This was followed by the announcement of its own game system, referred to as the OnLive MicroConsole TV Adapter. Unlike its name, the console was a compact affair with a

wireless controller, capable of turning any TV into a gaming screen with little more than an HDMI cable and an ethernet connection.

Sadly, all was not well. OnLive folded in 2012, resulting in numerous lay-offs and sale of assets – though the story wasn't quite over. A new company was formed – also called OnLive – running a smaller team and shifting focus by 2014 to a new service called CloudLift, which used cloud-based storage to allow gamers to switch between devices while playing the same game. A year later, though, in came Sony, buying up all of OnLive's assets, and announcing that it would be shutting down all of its services. Why was Sony so eager to snap it up? We'll get to that.

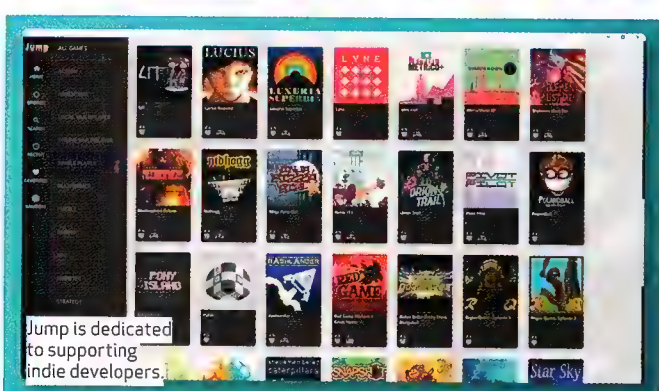
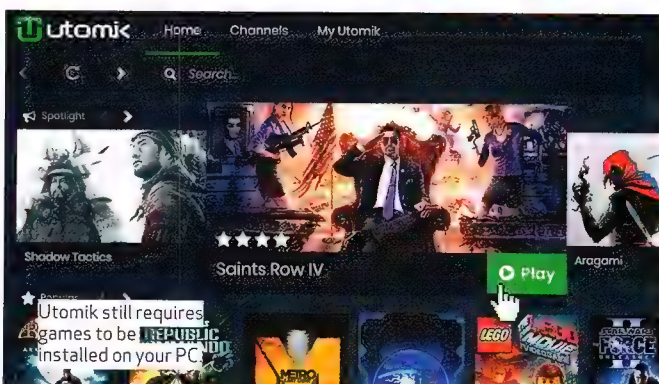
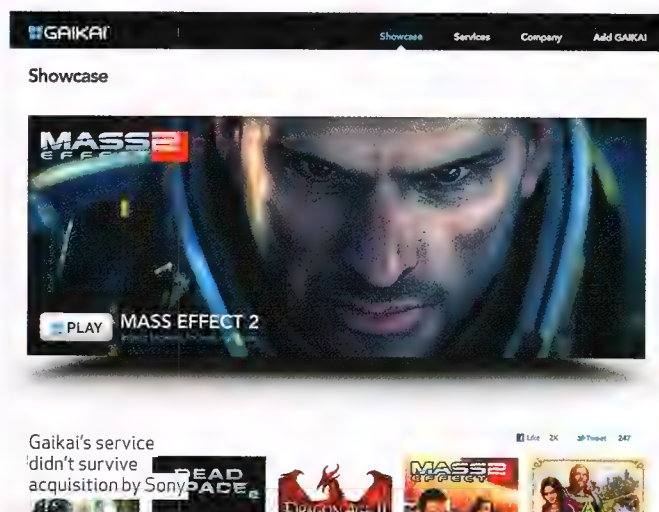
## SONY STREAMING

Around the same time, another Californian company named Gaikai was doing its best to perfect the tech. Early demos were impressive; games could be embedded on websites using Adobe Flash Player, and it demonstrated triple-A games such as Modern Warfare running effectively on tablets and PCs with a sufficiently fast internet connection. Gaikai enjoyed some success in 2011 and 2012, running a service model called the Ad Network, which enabled websites to stream demos of games and receive a portion of marketing revenue. It also

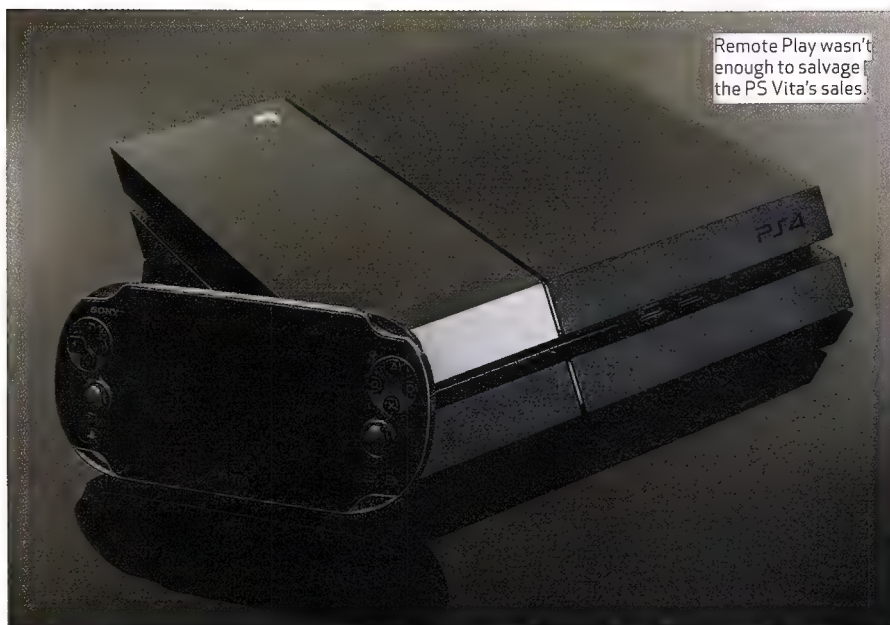
ran an Open Platform model, enabling the streaming of full games to a variety of devices.

Then, later in 2012, it swooped Sony, snapping up Gaikai for a hefty \$380 million. Gaikai's tech was put to good use at Sony, forming the basis for the PlayStation 4's Remote Play function. Remote Play had actually been around for a while at this point, available on the PlayStation 3, but it had to be integrated into games on a software level by developers. Very few releases had this function, because developers weren't willing to devote resources to supporting Sony's ailing PSP and PS Vita sales – there were only 14 physical releases that supported the Remote Play service across the PS3's entire lifespan.

The PS4, on the other hand, had Remote Play built into the hardware. With Sony taking the leap and installing the functionality on every PS4, the option of dipping out for game devs was gone: If you wanted your game on Sony's platform, it had to be compatible. Lo and behold, a home console that could stream to your handheld anywhere with a decent internet connection. This Gaikai-powered tech was relatively effective – latency still meant that high-intensity online shooters were out of the picture, but the principles of the software were sound. The main







stumbling block was the requirement of a PS Vita, but in 2014, the software became available for Sony smartphones and tablets, too, followed by Windows and MacOS.

### SCALED DOWN

This technology works as a microcosm of conventional cloud gaming services like OnLive and Stadia. In OnLive's model, games were run on a large remote server base, which could theoretically run any game, delivering high frame rates and graphical quality. Remote Play replaced the servers with the consumer's own PS4, which would simply run the games as normal while streaming video feedback one way and controller input the other, enabling near-seamless switching between a mobile device and the usual TV setup. Remote Play is still available, but failed to make a lasting impact. The next step, then, was for Sony to deliver its own PlayStation-branded cloud gaming service: In 2014, the world said hello to PS Now.

PS Now works much like OnLive did: Using a PS4 (and later, PCs), players can choose from a library of over 700 PlayStation 2, 3, and 4 games to stream from Sony data centers direct to their screens. Latency issues still plague the service, but it has performed well enough for Sony to keep rolling it out to new countries throughout 2019. OnLive's acquisition by Sony in 2015 saw its tech put to use in improving the PS Now service.

Sony appears committed to making the subscription-based service work, and the library is ever-expanding – although, tellingly, last year saw Sony announcing that some games would be available for full download on to consumers' PS4. This eliminated input latency issues caused by

streaming, but removed the instant-play benefits of fully streamed games. Still, PS Now continues to expand, with new games being added every month.

### LIKE AND SUBSCRIBE

Subscription-based gaming platforms that allow downloading local copies of games are nothing new, either. PC gaming service UtoMik acts as a middle ground between traditional user-ownership and fully cloud-based gaming. Rather than streaming from a server, UtoMik's games are partially downloaded to the PC, with nifty technology that adapts to the user's internet speed – with the company promising zero lag and buffering issues, regardless of your bandwidth. In our tests, UtoMik proved speedier and cheaper than normal purchased downloads, but not quite as instantaneous as cloud gaming. It works – games are ready to play within seconds, with no latency issues from data streaming, though the need for local hardware remains.

UtoMik's growth director, Patrick Weekers, had his own take on the Stadia announcement, remarking that "it proves public perception of subscription gaming (and access versus ownership) has evolved, which has caused big tech companies to scramble for a share of the market." Weekers wasn't overly impressed with Stadia, though, calling it "just another cloud streaming announcement," and commenting that "the technology for a fully streamed solution just isn't there yet. 5G networks, for example, are still being tested, meaning most consumers will not be able to use this technology any time soon, let alone on all devices at any time. That barrier isn't something you can punch through with capital." We're willing to bet that

## Consolation prize

Console gaming numbers have always fluctuated up and down, but home consoles do seem to be steadily trending downward as the costs associated with them increase. The peak of console gaming occurred around the turn of the millennium, with Sony's PlayStation 2 smashing every record to sell a whopping 150 million units. By comparison, the PlayStation 4 has only sold around 95 million units in the five-plus years since its release, while the Xbox One barely managed a measly 79 million. Nintendo dominated the handheld console market, with the Nintendo DS managing to match PS2-tier sales figures, and the Game Boy and Game Boy Color before it both topping 100 million units sold.

The rise of gaming-ready smartphones has hampered the handheld console market, though. The strange home-handheld hybrid Nintendo Switch has seen a modicum of success, but may bring a bulky handheld console with you to play Fortnite on your lunch break when you could just do it on the phone that's always in your pocket. Home console sales aren't exactly decreasing – they vary significantly, spiking around Christmas time every year – but they're not rising either. Sales remain mostly steady last year for all three major home consoles on offer right now (PS4, Xbox One, and Switch).

Elsewhere, Valve reported an \$800 million rise in profits from Steam sales revenue in 2017, while digital sales of home console games continue to struggle – indicating, perhaps, that serious gamers are slowly but surely making the switch to PC gaming. Streaming solutions do offer a potentially strong option for casual gamers, a cheaper barrier to entry, less required hardware, and no lengthy downloads or updates mean that services like Stadia could provide a more accessible way to play games – particularly if they expand on to smartphones.



Sony has never reached greater heights than the PlayStation 2's staggering sales figures.



## Game on

Playing games over a stream is a tricky business, not least because some games stream better than others. One of the key benefits of cloud gaming is the fact that it enables games to be played at a high level of graphical quality (thanks to powerful data center CPUs) on even the most basic devices. In theory, if you've got a screen and an internet connection, you should be able to instantly play games on ultra graphical settings. In practice, not every service has managed to deliver this. We've been banging on about latency a lot in this article, we know, but the fact is that it tends to tank a lot of fast-paced games. With that in mind, what are some good games to play over cloud gaming platforms?

Turn-based strategy and RPG games are excellent, particularly ones that are less visually demanding. Indie game *The Breach* is an ideal example of a game that runs perfectly when streamed, regardless of connection speed. Even real-time strategy titles such as *Total War* function reasonably well. *Doom Eternal* has been touted as the first triple-A launch title for Stadia, which is exciting – if it runs well. Demos we've seen so far have been visually appealing, but input lag means the game can stutter badly, leading to gameplay issues and an overabundance of motion blur.

The games that really suffer when run on cloud-based platforms are online multiplayer titles. Want to stream *Apex Legends* or *Call of Duty: Warzone*? Well, your input needs to go from the controller to your console or computer, then to the data centre where the game is hosted, then to the game's own servers, then all the way back again. Latency will shatter any notion of quick reaction times. *Rocket League*? Good luck with that.



*Doom Eternal* on Stadia felt a little rough around the edges when demoed at GDC.

Google will give it a shot, though – if any company has the bucks, it does.

Weekers isn't the only one unconvinced by Stadia. Another successful service of this sort is Jump, an indie-focused platform with a subscription fee of just US\$5 a month. With a curated library of over 100 indie titles, Jump recognised the hurdles to cloud-based gaming early on. Its HyperJump progressive download technology downloads games in small segments, then removes them once they're done being used, giving the impression of a fully installed game. This tech adapts to the user, keeping data from popular games cached to minimise load times.

Games can even be played in a browser – when we reached out to it, Jump was keen to emphasise the advancements in modern browser-based gaming, from speedy load times to shareable links to games and embedded demos. We gave Jump a go, and found that indie games could run flawlessly even on an iMac, in Chrome, with a dozen other tabs open. Somehow our computer didn't catch fire.

Jump CEO Anthony Palma voiced concerns about pricing and latency, commenting that "latency is inescapable in streaming until 5G and fibre are in every household," adding "I think streaming has potential to be a gamer's console replacement... in 10 years". Jump views subscription gaming as a "complement rather than a replacement" for user-ownership. Palma likened it to movies moving

from the theatre to subscription services; both are key revenue streams for the movie industry.

## STADIUM ROCK

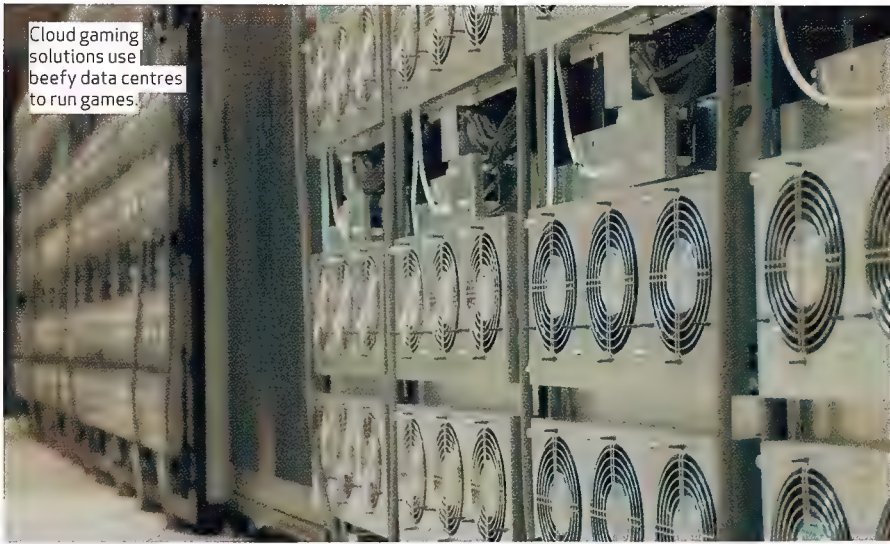
So, Google Stadia. It's a cool name, we'll give it that. Better than the achingly dull-titled Project Stream, which Google ran last year as a then-suspected, now-confirmed beta test for Stadia. Project Stream (ugh) saw recent releases such as *Assassin's Creed: Odyssey* running at 30fps and 1080p in ordinary browsers. The lower frame rate and resolution gave Project Stream space to mask latency issues, and *Odyssey* isn't a game that demands frame-perfect button inputs. Stadia, though, promises up to 4K 60fps gameplay with minimal latency. It's a bold claim, and one that comes with the caveat of an ethernet connection with high internet speed.

Stadia's fundamental systems work using familiar hardware; input is streamed directly to a Google server running your game of choice in one of its many data centres, which feeds back live video of the game to your device. AMD was pleased to announce its partnership with Google, its top-end data center GPUs powering Stadia's actual gameplay – although Google has been tight-lipped about the specifics, it's been revealed that the CPUs are actually Intel-powered. Stadia is promised to run on an assortment of desktops, laptops, smartphones, and tablets, although any mention of iOS was conspicuous by its absence in

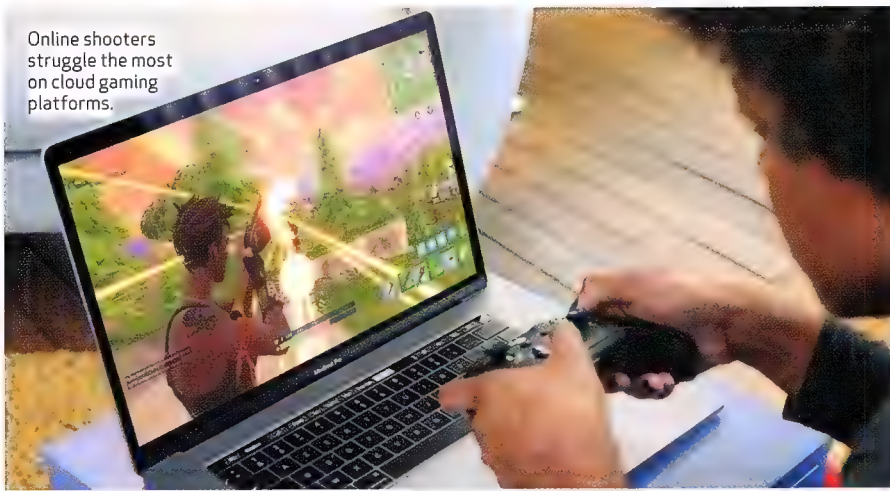
"Behemoths beware: the Stadia controller's central buttons are very tiny."







Cloud gaming solutions use beefy data centres to run games.



Online shooters struggle the most on cloud gaming platforms.

project leader Phil Harrison's presentation at GDC 2019. Predictably, Apple revealed its own competing service – Apple Arcade – not long after. Details are thin on the ground, but Arcade seems to have more of a focus on mobile gaming than Stadia.

What sets Stadia apart is its controller. The Stadia gamepad should be familiar to anyone who's handled any home console controller, connecting directly to your home Wi-Fi to cut out some of the latency issues that come with traditional controllers, which need to send input data through a local device first. The controller also comes with an integrated mic, plus buttons for Google Assistant and video capture. The controller doesn't have a catchy, Google-themed name yet, but we wouldn't be surprised – especially as it's the only piece of new hardware you need to buy to get playing. StadPad? Google Croissant? You can have those for free, Google.

UNCERTAIN FUTURE

Stadia is about nine months away from commercial release, but there seems to be an incredible number of unknowns around it. Streaming-based gaming

services are not, in broad terms, aimed at PC gamers. Console gamers are more likely to benefit; home consoles are expensive, borderline impossible to upgrade, and most now come with their own subscription-based services for online play. Games themselves, too, are becoming costlier, particularly for current-gen consoles. Streaming solutions like Stadia could banish all of these expenses, but they come with their own costs. An internet connection capable of supporting the service results in a price tag that isn't exactly small.

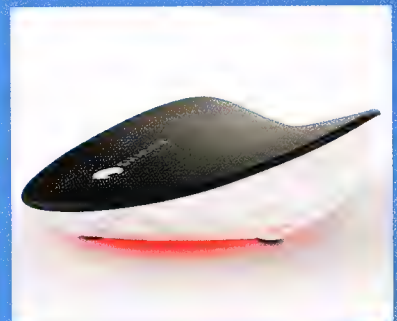
Will Google offset the prices with ads? Will there be a subscription service – and if so, will there be free and premium versions? How much will the controller cost? There are so many uncertain variables surrounding the Stadia, it's difficult to gauge whether it will soar higher than any platform before it, or crash out OnLive-style. The phrase "Netflix of games" is bandied around a lot, but is that really what gamers want? "YouTube of games" might be more appropriate; the idea of a free cloud gaming service with an available premium membership sounds attractive, and the potential ad

Cloud and proud

A quick Google search for "failed game streaming services" rather damningly places OnLive at the top of the results list. It wasn't the only one to fall in the face of traditional downloads and physical copies, though. Gaikai's tech might have gone on to form a powerful baseline for PlayStation Now, but its original service failed to gain much momentum. Elsewhere, Square Enix's ill-fated effort *Strm* lasted less than two years before it admitted defeat and shut it down, resulting in a loss of more than \$16 million. Others simply vanished into the ether. If you've heard of InstantAction or GameFly, congratulations – you've been paying more attention than most.

GeForce Now, Nvidia's attempt at a cloud gaming platform, has been in an open beta state for months now. It allows users access to a server-hosted Windows environment running powerful GeForce graphics, where they can install and play games they already own from digital suppliers such as Steam or Origin. While nifty, it doesn't push the boundaries of what cloud gaming is capable of, and seeing its competitor AMD cozying up with Google for Stadia must be making a few Nvidia execs nervous.

One platform that has seen some real success is Shadow – a service comparable to GeForce Now that sees users connecting to a dedicated machine in one of Shadow's data centers, then using that machine to play games they already own in up to 4K 60fps, with multiplatform support available. Shadow has received acclaim from gamers (even a professional *CounterStrike: Global Offensive* team) regarding the quality of the service, but it demands 15Mb/s or faster internet, and comes with an eye-watering \$35 a month price tag – on top of the cost of the games. And lastly, no, Netflix doesn't count, no matter how much you enjoyed *Black Mirror*. Bandersnatch.



Shadow has its own hardware, namely the Shadow Ghost.



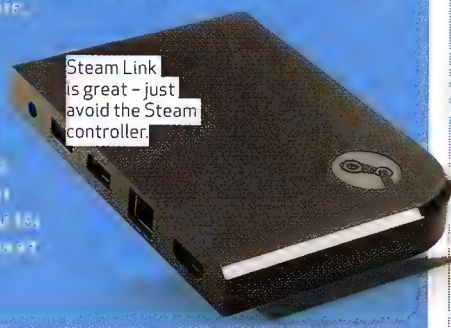


## Stream it yourself

Much like PlayStation's Remote Play, there are other ways to stream games yourself, without the aid of a hulking data center. Kids, hogging the TV? Xbox One enables you to stream games to any Windows 10 PC connected on the same network, using the computer's monitor as a second screen, and connecting a standard Xbox controller. Because the game is effectively played in situ on the console, players can return directly to the big screen once the living room has been vacated.

Steam users have this option, too, albeit in reverse: In November 2015, Valve launched Steam Link, which enabled anyone to stream their Steam library from their gaming PC to their smart TV or mobile device, over a local connection. Initially, Valve sold a piece of hardware that supported Steam Link – a black box reminiscent of the Orin console – but it was discontinued following the rise of smart TVs, which could support Link via an app. For the smart-TV-less, it's still possible to pick up a Link unit on Amazon, or use a Raspberry Pi to replace it – Valve's software is eminently compatible with the single-board computer. Just don't bother getting a Steam controller for it.

Another option for home streaming is Apple's AirPlay. Apple TV supports recent-screen functionality for other Apple hardware, enabling a spot of couch gaming. Apple's tech isn't exactly ideal for gaming, to be fair, but it's good for a few games of *Fortnite* on the big screen without needing to splash out for a console or gaming PC (if you're a Mac fiend). Google Chromecast also enables your TV to display a live stream from your PC, but in practice this tends to be poor for gaming – sorry Google fans, you'll need to wait for Stadia.



revenue for Google is massive.

Internet speed requirements are a huge concern for would-be promoters of the Stadia, too. Google recommends a minimum of 25MB/s – more than five times Sony's recommended speed for PlayStation Now. Some games are sure to devour bandwidth, and for users with limited data plans, Stadia could prove disastrous. Its performance on low-end routers and broadband packages remains to be seen, but we can't imagine it's good. Even on the Moscone Center's presumably industrial-standard internet at GDC, demos showed slowdown and input latency.

## HEAD IN THE GAME

And what of the games? *Doom Eternal* is a big-name title lined up for Stadia's launch, but we've seen little else – just *Assassin's Creed: Odyssey* (feels like it's everywhere right now). *Odyssey* looks beautiful, making it ideal for hardware demos, and it's no surprise it was the star of the show at the Stadia reveal; Ubisoft CEO Yves Guillemot is a big proponent of cloud-based gaming. In an interview with *Variety* last year, he stated that he expected to see "less and less hardware" in the future of gaming, claiming that "there will be one more console generation and then after that, we will be streaming, all of us."

AMD promises a "robust" suite of tools for developers to optimise their games, and Stadia is interestingly mostly running off a heavily modified Linux variant. Ogi Brkic, general manager of AMD's data center GPU business unit, stated recently that AMD was "delighted to work with Google" on Stadia, promising "the reliability and no-compromises performance they (gamers) expect". Google and any developers working on Stadia projects will be able to use the open-source Linux drivers to more closely examine the code at play. It's certainly promising, but there's no way of knowing whether devs will take to it. Games will require changes in code design to run effectively on Stadia, and it could be that developers decide that it isn't worth the hassle. Stadia is more likely to unsettle the casual end of console gaming than hardcore PC gamers, but tackling the giants that are Sony, Microsoft, and Nintendo on their home turf won't be easy.

Whether Stadia will also support downloading local copies of games for improved performance – like *Utomik*, or Xbox's Game Pass – remains to be seen as well. What becomes of personal ownership when a platform only offers access to games on a subscription basis? Subscriptions are becoming less popular in the gaming world; a decade ago, *World of Warcraft* boasted seven-figure member counts, but those numbers have been trending steadily downward, while modern free-to-play games such as *Fortnite* operate a season pass system rather than premium membership subscriptions. It's easy to argue that fully subscription-driven games will never overtake the simple pleasure of buying a game once and owning it forever. That said, many were skeptical of Netflix when it emerged, and now DVD retailers are being crippled by the video-streaming giant.

So, is streaming-based gaming the way of the future? We don't really think so, but we're ready to be proven wrong. It feels as though we're stuck in a loop: this streaming technology keeps coming around, and each time the industry arrives at the same conclusion: It's a nice idea, but typical internet connection quality isn't enough to support it. Stadia is flashy, and Google undeniably has the power to throw staggering amounts of money at it, but if it won't run on your average household broadband, there's no way it can take off. But hey – it's early days. Stadia is set to launch at the end of 2019, and a lot could change in that time. ■



# 60

## WAYS TO CUSTOMISE WINDOWS

Nick Peers reveals quick tips and tricks to give Windows a fresh look.

Off-the-shelf is good as far as it goes, but there comes a time when you want to put your personal stamp on something, and with Windows, you'll be surprised by just how much control you can wield over its look and feel. We've dug out no fewer than 60 tips to help you customise it to your personal satisfaction.

There's a reminder of some familiar tips, but we've dug deeper to reveal buried settings and little-known techniques that can do more than simply change the background picture or apply a color scheme. Indeed, we open this feature by introducing two free tools that, between them, open up a

wide array of customisable options that normally require you to be a maestro at Registry editing. You'll tackle the desktop and its constituent parts: Start menu, Taskbar, and File Explorer. You'll also discover how to replace parts of the desktop with more visually appealing (but no less practical) alternatives, transform the way you navigate your filesystem with a handy File Explorer add-on, and even make fundamental changes to the desktop itself, replacing the Windows 'skin' with an alternative, offering not just a new coat of paint, but a fresh approach to how you interact with Windows. Come on, let's get those brushes out...





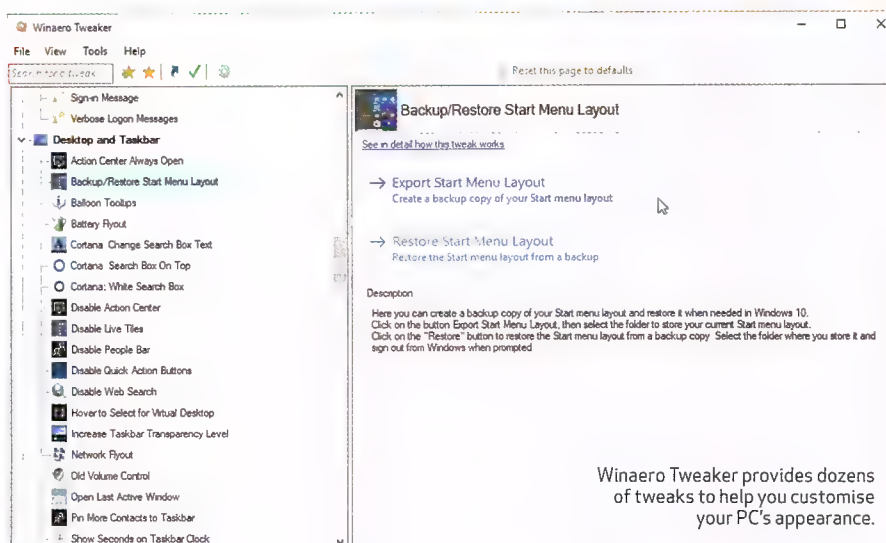
# Desktop, Taskbar, & Start Menu

**01 TOOLS OF THE TRADE** Many of the tips in this feature can be applied with the help of two powerful tweaking tools, so start by downloading both Ultimate Windows Tweaker (<https://bit.ly/uwt-10> – you'll find links to Windows 7 and 8.1 versions here, too) and Winaero Tweaker (<https://winaero.com/download.php?view.1796>). Once downloaded, extract the contents of the ZIP files – Ultimate Windows Tweaker runs as a portable app, and Winaero Tweaker gives you the option of installing it in portable form, too.

**02 QUICKLY ACCESS WINDOWS' PERSONALISATION SETTINGS** To start customising, right-click the desktop and choose "Personalise" to jump straight to "Settings > Personalisation > Background." From here, you can change your background to a picture, a solid color, or a slideshow of photos within a single folder on your PC.

**03 CUSTOMISE YOUR DESKTOP BACKGROUND** If you're dissatisfied with Windows' rather meager desktop background offerings, download and install John's Background Switcher from <https://bit.ly/johnbckswtch> for more choice – after installation, you're directed to the "Add" button, where you define sources for your photos. These can include specific folders on your PC as well as various online sources (including Dropbox and OneDrive folders, plus RSS feeds, Instagram, Google, and Flickr).

You'll see several switching options at the bottom of the main window – pay attention to the "Picture Mode"



Winaero Tweaker provides dozens of tweaks to help you customise your PC's appearance.

drop-down, where you can display multiple photos at once in various ways. There's also a "More" button for fine-tuning all aspects of this clever background tool.

**04 OVERRIDE COLOR SCHEME** Windows automatically changes the color scheme of desktop items to match the background, but you can also force your own choice of color via "Settings > Personalisation > Colors." You can switch between light and dark modes here, too.

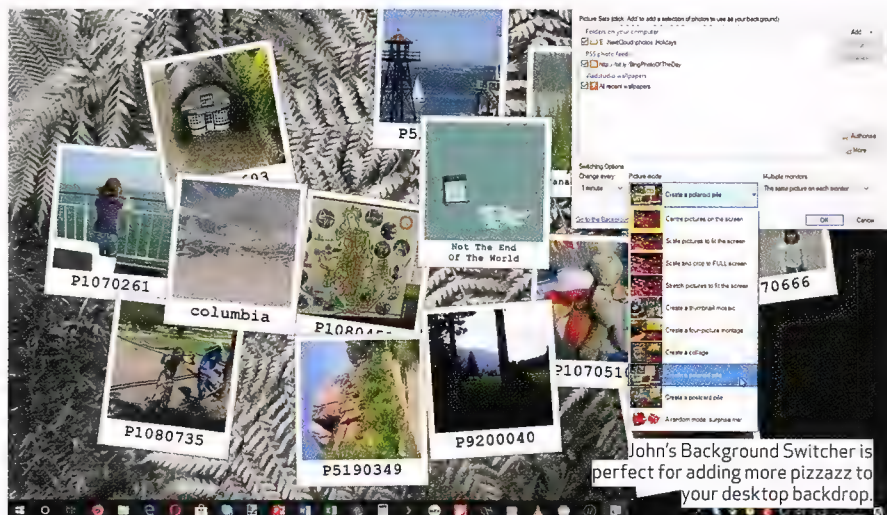
**05 CREATE CUSTOM COLOR PALETTE** Fed up with having to click "Custom Color" to choose a different one to Windows' own offerings? Fire up Winaero Tweaker and go to "Appearance > Custom Accents," where

you can define up to eight custom colors of your own. These appear under "Recent Colors" in the "Personalisation" dialog box for easy access.

**06 PICK A THEME** The quickest way to change your desktop appearance is through the "Themes" section under "Settings > Personalisation." Several are provided, or click "Get More Themes in Microsoft Store" to browse hundreds more – click "Get" followed by "Install" to add one to your collection. Some themes change the mouse pointer and desktop icons – you can prevent them from doing so in Winaero Tweaker under "Appearance > Theme Behavior."

**07 CHANGE YOUR ACCOUNT PICTURE** Open a photo of yourself in an image editor like Paint.NET ([www.getpaint.net](http://www.getpaint.net)), then crop in to a headshot (make the selection tool 1:1 for a perfectly square crop), and save the image. Now navigate to "Start > Settings > Accounts," and click your current photo under "Your Info" to select the new one. Previous shots are kept, enabling you to switch between them.

**08 SET UP A SCREENSAVER** Energy-saving LCD monitors have largely rendered screensavers redundant, but if you're still hankering after one, head to "Personalisation > Lock Screen," then scroll down and click "Screensaver Settings" to set one up. Download more screensavers from [www.screensaversplanet.com](http://www.screensaversplanet.com) (many of





which are free) – save the EXE file to your computer, then double-click it to add the screensaver to the available list.

## 09 START MENU PRECAUTIONS

Before making major

**09** Before making major changes to your Start menu, navigate to “Desktop and Taskbar > Backup/Restore Start Menu Layout” in Winaero Tweaker to export the current layout – just in case.

## 10 CUSTOMISE THE START MENU

Use the "Personalisation >

**10** Use the “Personalisation > Start” section of “Settings” to configure certain aspects of the Start menu. Tiles can be added by right-clicking items and choosing “Pin to Start Menu.” You can then click and drag items around to rearrange them, or click and drag items on top of each other to group them in a folder.

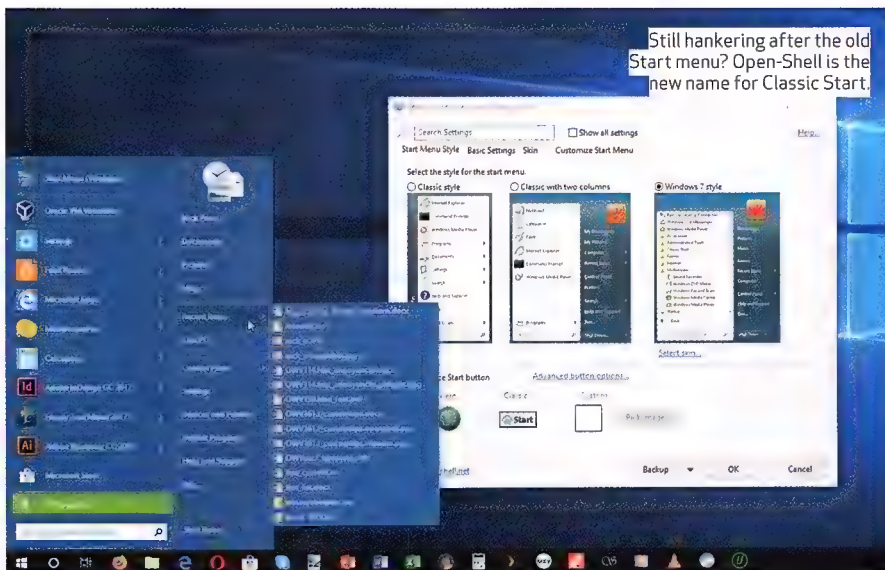
## 11 LOCK THE START MENU

After you've set up the

After you've set up the tiles to your satisfaction, open Ultimate Windows Tweaker and navigate to "Customisation > Universal UI," then check "Lock Start Tiles" to prevent accidentally rearranging them in future.

## 12 DITCH THE START MENU

## 12 Still hankering after the Windows 7 Start menu? Our old favorite alternative Start menu – Classic Start – has been resurrected



Still hankering after the old Start menu? Open-Shell is the new name for Classic Start.

under a new name, and updated to work with the latest version of Windows 10. Download and install Open-Shell from <https://open-shell.github.io/Open-Shell-Menu> – during installation, click “Classic Explorer” and “Classic IE,” and choose “Entire feature will be unavailable” to avoid installing them.

### 13 CUSTOMISE THE QUICK ACCESS MENU

## 13 CUSTOMISE THE QUICK ACCESS MENU

Press Win-X to access the alternative Start menu. You can choose which options appear on it by

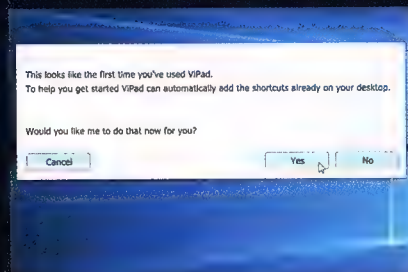
downloading and running the portable Win-X Menu Editor (<https://winaero.com/download.php?view.21>).

## 14 RESTORE DESKTOP GADGETS

## 14 RESTORE DESKTOP GADGETS

Do you miss the old Windows 7 gadgets that provide extra functionality on the desktop? Visit <http://win10widgets.com> to download Win10 Widgets, a customised version of Rainmeter ([www.rainmeter.net](http://www.rainmeter.net)), with the gadgets pre-installed and running.

## 15 ORGANISE YOUR DESKTOP ICONS



## INSTALL ICONS

Download and install Vi-Pad (<http://lee-soft.com/vipad>) – if the SmartScreen filter appears, click “More” and unblock the program. During installation, click “Yes” when prompted to copy all existing desktop icons to the Vi-Pad window, which will happen in real time as you watch.



**ORGANISE ICONS**

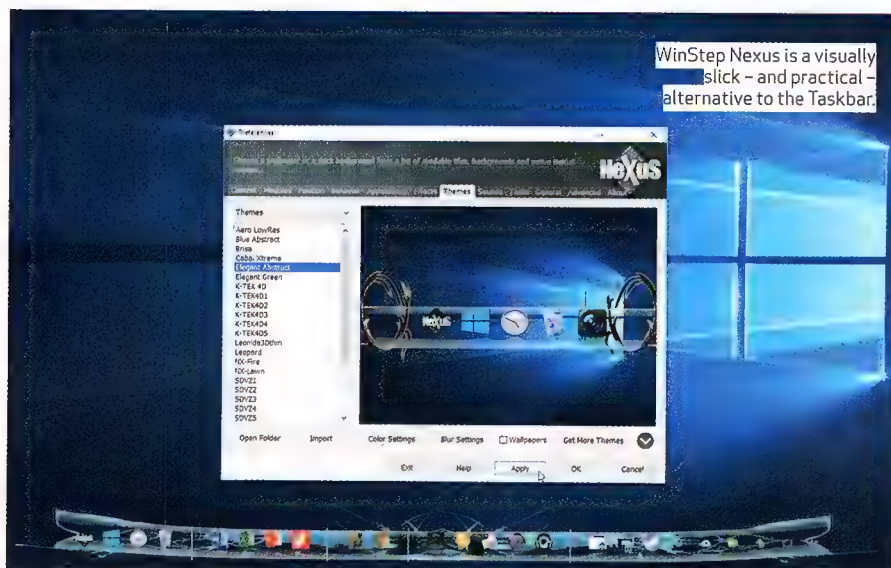
**B** All shortcut apps appear in a single tab – “New Tab” – spread over multiple pages. Right-click “New Tab” to rename it, or use the “+” button to create additional tabs, so that you can organise your apps into more categories. Once that’s done, right-click an app icon to move it to that tab.



**C** You can drag new shortcuts into any tab from the desktop or from File Explorer. Right-click the program's Taskbar notification area, and choose "Settings." Uncheck "Use Windows DWM" to make it translucent. You can also make the icons larger or smaller, using the slider at the top of the menu.



# Taskbar and notifications



**16 MAKE USE OF THE TASKBAR**  
The Taskbar is the best location for any, and all, shortcuts that you need. Right-click your existing desktop or Start menu shortcuts, and choose “Pin to Taskbar” to add them. You can then drag and drop icons within the bar to order them logically.

**17 MINIMISE THE SEARCH BOX**  
Does the new search bar take up too much room on your Taskbar? Right-click an empty part of the Taskbar, and choose “Cortana > Show Cortana Icon” to replace it with a clickable icon; or choose “Cortana > Hidden” if you never use it.

**18 RESIZE THE TASKBAR**  
Running out of space for shortcut icons? Make them smaller by right-clicking the Taskbar, choosing “Taskbar Settings,” and flicking the “Use Small Taskbar Buttons” switch to “On.” Or right-click the Taskbar and uncheck “Lock the Taskbar.” Click the top edge of the Taskbar and drag up to add space for an extra row.

**19 MOVE THE TASKBAR**  
While it’s unlocked, you can also click and drag the Taskbar to a different edge of the screen – pin it left or right for a vertical list, or at the top if it suits your way of working better.

**20 SHOW LABELS**  
If you only have a handful of icons on the Taskbar, open Taskbar settings, scroll down, and

change “Combine Taskbar Buttons” to “When the Taskbar is Full” or “Never” to view a label, which helps you to easily view – and switch between – open documents within the same application.

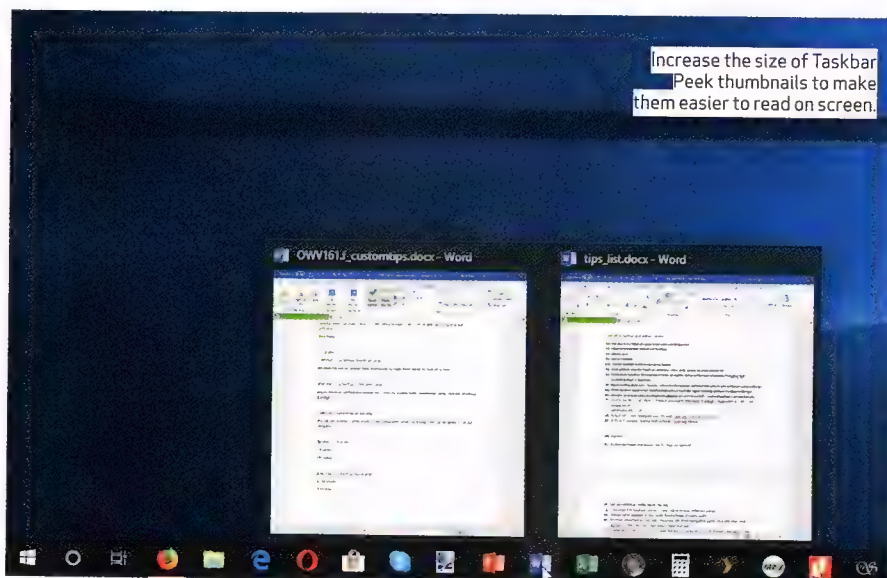
**21 ADD TOOLBARS**  
Right-click the Taskbar and you’ll see a Toolbars menu, enabling you to add extra features to it – you can select “Address” to add a URL bar for opening websites in your default web browser, for example. To add easy access to your entire PC, choose “Toolbars > New Toolbar.” Select “This PC” and click “Select Folder.” From here, click “>>” next to “This PC” to access any folder or drive with just a few clicks.

**22 INCREASE THE SIZE OF TASKBAR PEEK THUMBNAILS**  
When you roll your mouse over an open program’s Taskbar icon, you get a pop-up thumbnail of open document(s) – it’s a bit small, so open Ultimate Windows Tweaker, navigate to “Customisation > Taskbar,” and try setting the minimum and maximum thumbnail size sliders to 400. Click “Apply Tweaks,” and after File Explorer restarts, you should instantly see an improvement.

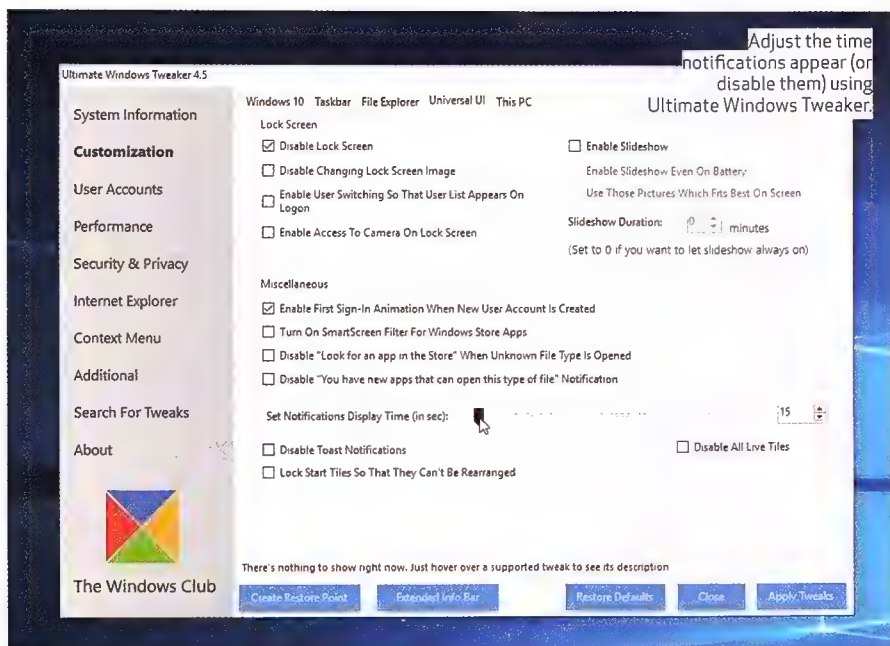
**23 TWEAK THE NOTIFICATION AREA**  
You don’t need to delve deep into Taskbar settings to change the behavior of the Taskbar’s notification icons. Simply drag icons between the notification area and its “holding area” (click “^” to reveal it). To remove icons permanently without closing the parent application, check out the program’s own settings.

**24 CLEAR SYSTEM ICONS**  
Windows places several icons of its own in the Taskbar notification area – some elements, such as the touchpad or touch keyboard, can be shown or hidden via the Taskbar’s right-click menu; others, including the clock and the Action Center button, can be removed under Taskbar settings (click “Turn System Icons On or Off” under “Notification Area”).

**25 ADJUST NOTIFICATION POP-UPS**  
While you can tweak many aspects of the Action Center on your PC







them to the dock – but you can also add modules such as email checker and weather forecast gadgets.

**27 TWEAK THE ALT-TAB MENU** It may not be as glamorous as the new Timeline, but the Alt-Tab feature is still the quickest way to switch between open apps and windows on your PC. Tweak its looks courtesy of Winaero Tweaker: Navigate to “Appearance > Alt + Tab Appearance,” where you’ll find sliders to adjust its transparency, plus make the desktop darker when it’s invoked.

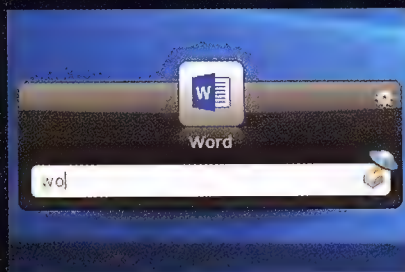
**28 MINIMALIST ALT-TAB** You’ll also see an option to “Enable Classic Alt + Tab Dialog” – check this, then click “Restart Explorer” to replace the thumbnails with a minimalist icon-based task switcher, with the currently selected icon’s window title displayed beneath it to help you navigate.

via “Settings > System > Notifications & Actions,” one thing you can’t do from here is adjust how long – five seconds – individual notifications appear on screen. To change this setting, open Universal Windows Tweaker to the “Customisation > Universal UI” tab. The slider enables you to increase the time from five seconds right up to 300 seconds. Alternatively, you can disable them completely (check “Disable Toast Notifications”).

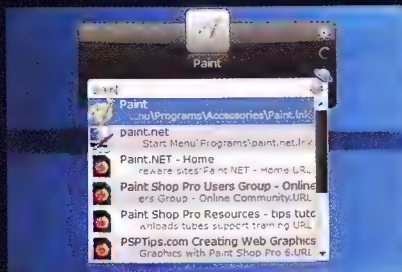
**26 REPLACE YOUR TASKBAR** The Windows Taskbar is efficient, but not exactly visually pleasing. Fans of the macOS dock should examine the free version of WinStep Nexus ([www.winstep.net](http://www.winstep.net)), which combines a more eye-catching aesthetic with functionality that renders the Taskbar redundant. Not only does it include all the expected features – drag and drop shortcuts from your Start menu or desktop to add

**29 MULTI-DISPLAY SETTINGS** If you have two monitors connected to your PC, head over to the Taskbar settings, where you’ll see options for configuring the Taskbar independently on each display – we recommend selecting “Taskbar Where Window is Open” on the “Show Taskbar Buttons On” drop-down menu, to avoid confusion.

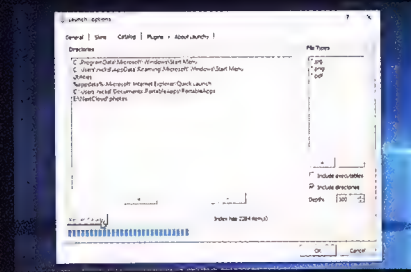
## 30 LAUNCH PROGRAMS QUICKLY



**A GETTING STARTED** Download Launchy from [www.launchy.net](http://www.launchy.net) – you can either install it or run it on demand as a portable app. Once Launchy has, er, launched, it sits unobtrusively in the Taskbar notification area. To bring it into focus, press Alt-Spacebar, then start typing the name of what you’re looking for.



**B SEARCH AND SELECT** An icon representing a program pops up – if it’s the correct one, press Enter. Wait a few seconds, and more matching results – including web links – appear via a drop-down menu. Click one or use the arrow keys to scroll through the list, pressing Enter when you find your match.



**C WIDEN LAUNCHY’S SEARCH REMIT** Right-click the Launchy notification area icon and choose the “Options > Catalog” tab. Click “+” under “Directories” to add additional folders to include, then with the directory selected, click “+” under “File Types” to list file types to search. Finally, click “Rescan Catalog.”

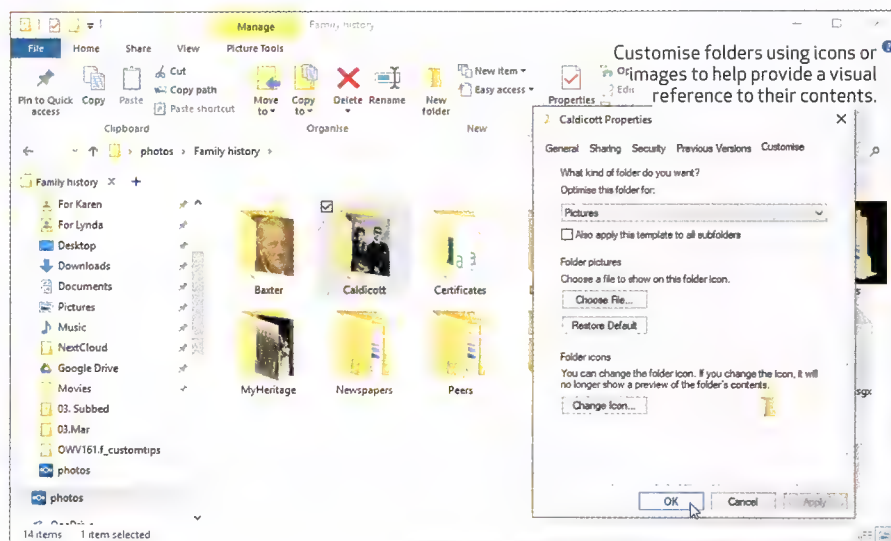


# File Explorer

**31 CUSTOMISE FOLDER BEHAVIOR** Windows can be instructed to treat folders in a specific way depending on the contents inside. Right-click a folder and choose "Properties > Customise," where you can optimise it for a specific file type, such as pictures or documents.

**32 CHANGE THE FOLDER ICON** You'll also see an option to change the folder icon – useful if you want a more visual prompt as to the folder's contents. Click "Change Icon" to browse files for any icons they contain ("shell32.dll" is selected by default, with lots of options). You can also select previously created or downloaded icon (ICO) files – see the step-by-step guide on the page opposite for a way to extract icons from other files. Alternatively, click "Choose File" to choose a picture to display instead – this is perfect for photo folders, where you'd rather focus on one of the photos inside than have Windows display several of them at once.

**33 SET UP INDIVIDUAL FOLDER VIEWS** Windows also remembers any individual customisations that you perform on a folder, so after opening it, switch to the "View" tab on the File Explorer's Ribbon, where you can experiment with the "Layout" and "Current View" sections to apply settings that will remain specific to that particular folder whenever you reopen it.



**34 ADJUST ICON SPACING** Further tweaks can be performed using Winaero Tweaker – navigate to the "Advanced Appearance Settings > Icons" section, where you can adjust the horizontal and vertical spacing of icons in both File Explorer and on the desktop, plus change the default font used to display names.

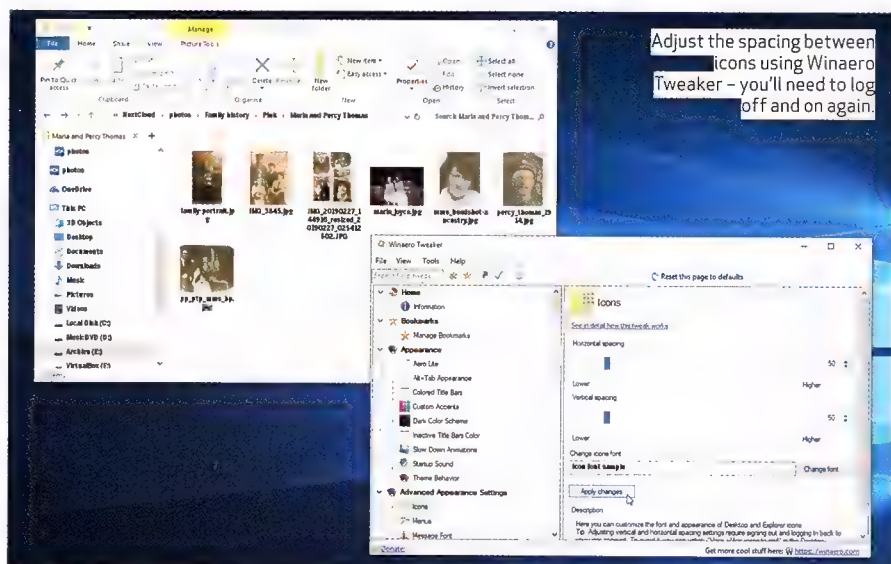
**35 TWEAK FILE EXPLORER PANES** File Explorer displays two panes – Navigation and Details – by default, but you can also add a Preview pane via the Ribbon's "View" tab, plus restore Libraries to the Navigation pane by clicking it and choosing "Show Libraries."

**36 SET UP QUICK ACCESS** The Quick Access section of the Navigation pane is File Explorer's best feature, bar none. You can drag frequently accessed folders into here to pin them for one-click access from any File Explorer location. You can also click and drag existing entries to rearrange their running order, or right-click to unpin them.

**37 CLEAN THE NAVIGATION PANE** The Navigation pane can get cluttered with lots of entries you don't use. The simplest way to review and remove these is to open up Winaero Tweaker to "File Explorer > Navigation Pane – Default Items." Want to add your own links? Select "Navigation Pane – Custom Items" in order to do so.

**38 CUSTOMISE NAVIGATION PANE ITEMS** You can rename the "Quick Access," "Libraries," and "This PC" icons in the Navigation pane via Winaero Tweaker's "File Explorer" section, too. You can also change their icons in the same way that you edit any folder icon.

**39 CUSTOMISE THE "THIS PC" VIEW** Given that most of us open File Explorer to "This PC" by default, it helps if you can tailor it to your exact needs. Fire up Ultimate Windows Tweaker, and navigate to the "Customisation > This PC" option, where you can decide which user folders should be displayed, as well as adding various useful system shortcuts at the same time.



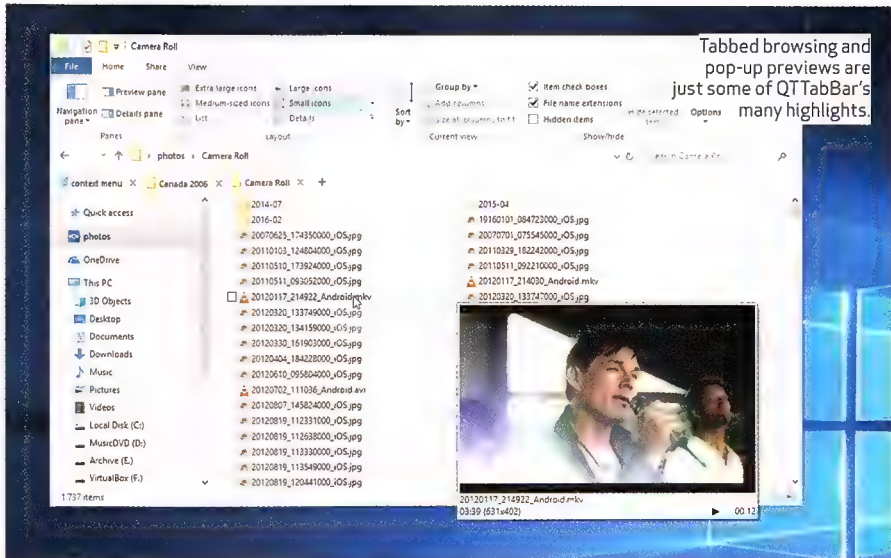


**40** **ADD TABS TO FILE EXPLORER**  
Your web browser has tabs to reduce window clutter, so why not File Explorer? We've been using QTTaBar (<http://qttabar.wikidot.com>) for the best part of a year to do just that. Once installed, tabs appear beneath the Ribbon – click “+” to browse for a new tab, or press Ctrl-N to duplicate the current tab.

**41** **NAVIGATE SUBFOLDERS QUICKLY**  
There's another fringe benefit to using QTTaBar: After installation, roll your mouse over a folder icon and click the drop-down arrow that appears over it to drill down through the folder's contents using a series of drop-down menus.

**42** **POP-UP FILE PREVIEWS**  
QTTaBar also enables you to ditch the preview bar; instead, roll your mouse over a supported file type, and after a short pause a pop-up preview appears. You can configure the size of the thumbnail (and other QTTaBar options) by right-clicking an empty space on its tab bar in File Explorer, and then choosing “QTTaBar Options” – look under “Preview > Windowing.”

**43** **CUSTOMISE CONTEXT MENUS**  
The right-click menu is a handy place to stash useful – if not frequently needed – tools. You



can add numerous entries to this using Winaero Tweaker's “Context Menu” section – you can access the new Clipboard History feature, for example, or restore access to classic appearance options in Windows 10 (see “Personalisation”). It also contains system tools that enable you to do things such as claim ownership of a folder or reset its permissions.

**44** **CLEAN OUT THE CONTEXT MENU**  
Select “Remove Default Entries” in Winaero Tweaker to clear

out unused entries added by Windows, such as BitLocker entries. Most clutter, however, comes from third-party tools. If you can't find options to remove them within those programs, use a tool such as ShellMenuView ([www.nirsoft.net/utils/shell\\_menu\\_view.html](http://www.nirsoft.net/utils/shell_menu_view.html)) to review and remove unwanted entries. Doing so can be daunting, but ShellMenuView is comprehensive, and all its options are grouped by app, making them easy to detect and, if necessary, remove in bulk.

**45** **EXTRACT PROGRAM ICONS**

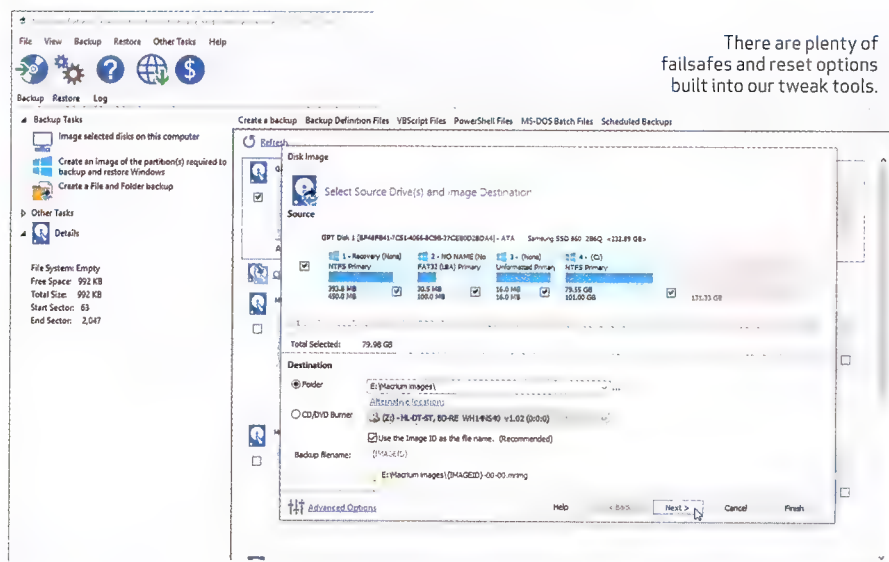
**A CHOOSE WHERE TO SEARCH**  
Download Icons Extractor as a ZIP file from [www.nirsoft.net/utils/iconsext.html](http://www.nirsoft.net/utils/iconsext.html), then extract its contents, and double-click “iconsext.exe” to launch the program. You have the option of choosing to search a specific file, all the files inside a folder, or a running process for icons.

**B SEARCH AND BROWSE**  
Click “Search For Icons” and wait while the folder is searched – doing so can take some time, and a counter indicates how many matches have been found. You can click “Stop” at any time to halt the search and view the matches found so far. Double-click a match to view the available icons.

**C BROWSE AND EXTRACT**  
If a suitably large (128x128 or preferably 256x256 pixels) icon exists, you can either select it and click “Copy Selected Image” to copy it to the clipboard, or close the dialog box, right-click the icon, and choose “Save Selected Icons” to save it as an ICO file for use elsewhere.



# Take things to the next level



There are plenty of failsafes and reset options built into our tweak tools.

## 51 CHANGE WINDOWS' START-UP SOUND

You can customise your Windows sound scheme by typing "sounds" into the Settings search box and selecting "Change system sounds." What you can't do from here is change the Windows start-up sound. Instead, navigate to "Appearance > Startup Sound" in Winaero Tweaker, where you can apply your own choice of WAV file in place of the default. If your chosen file is in another audio format, convert it using Pazera Free Audio Extractor ([www.pazera-software.com/products/audio-extractor/](http://www.pazera-software.com/products/audio-extractor/)).

## 52 SWITCH SYSTEM FONTS

Tired of the rather conservative Segoe UI font used by Windows for its desktop components? Then swap it out for something more glamorous (but legible) via Winaero Tweaker's "Advanced Appearance Settings > System Font" screen. Log out and back in again to see the effect.

## 53 REDUCE WINDOW CLUTTER

You've added tabs to File Explorer, how about grouping application windows in a single multi-tabbed window, too? TidyTabs ([www.nurgo-software.com](http://www.nurgo-software.com)) enables you to drag up to three windows on top of each other to group them, then use the tabs to switch. Upgrade to the Pro version (a measly \$9) and you can automatically group windows from the same application together, plus group more than three windows at once.

## 46 TAKE PRECAUTIONS

We're now entering potential risk territory with some of these tips. Therefore, make sure you have some kind of system backup in place – either a rollback option such as System Restore or Rollback Rx (<https://horizontdatasys.com/download>), or an up-to-date drive image using Macrium Reflect Free ([www.macrium.com/reflectfree.aspx](http://www.macrium.com/reflectfree.aspx)). Done that? Good, let's move on...

## 47 CUSTOMISE LOCK SCREEN

Can't tweak the lock screen to your satisfaction using the options found under "Settings > Personalisation > Lock Screen"? Then take a look at the "Boot and Logon" section of Winaero Tweaker for more possibilities, such as not automatically selecting the last logged-on user by default, or adding a limit to how long the slideshow feature plays for.

## 48 GRAB LOCK SCREEN IMAGES

If you're using the Windows Spotlight feature to display rotating background images, and you'd like a permanent copy of any or all of them, select "Find Lock Screen Images" in Winaero Tweaker, followed by "Get this one" under the current photo (if it's displayed) to save it, or "Get all images stored on this PC" to copy them to a desktop folder.

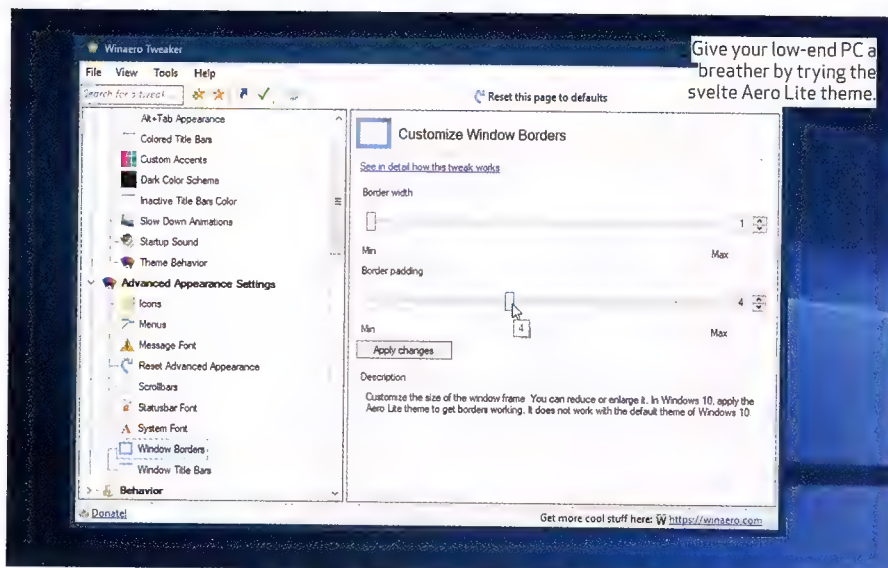
## 49 APPLY THE AERO LITE THEME

Aero Lite is a no-frills theme particularly suited for low-end PCs, such as 2-in-1 tablets. If you think it might help with

performance – or want to see if its clean and simple lines appeal – open Winaero Tweaker and click "Enable Aero Lite (default)" under "Appearance > Aero Lite." You can undo it from here, too.

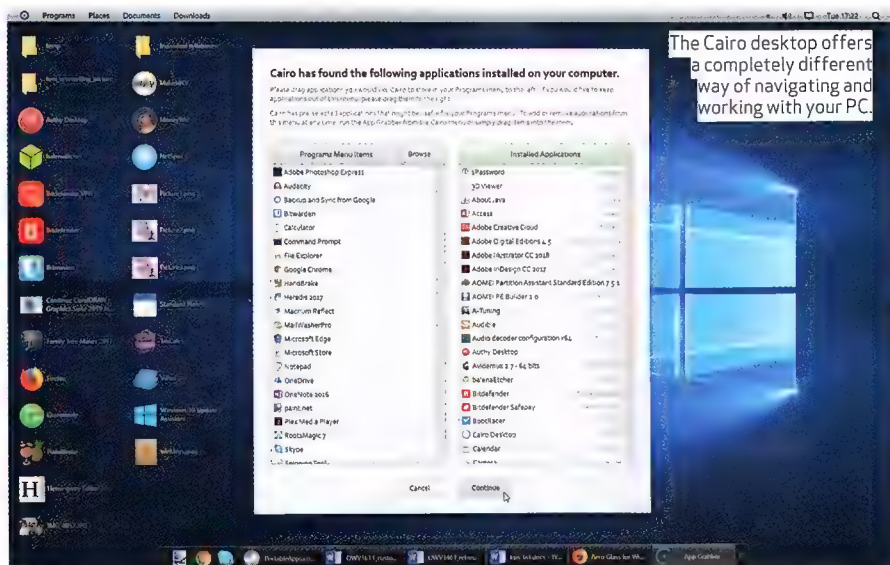
## 50 CUSTOMISE AERO LITE

Once enabled, select "Window Borders" under "Advanced Appearance Settings" to change the width and padding of windows – changes are performed in real time. You can also change the height of the window title bar and change the font – this requires logging off and on again, but also works with other desktop themes, too.



Give your low-end PC a breather by trying the svelte Aero Lite theme.





**54 GET THE AERO GLASS LOOK**  
If you're a tech-savvy Windows 8.1 user, head to [www.glass8.eu](http://www.glass8.eu) to download Aero Glass for Windows 8 if you'd like to restore the translucent Aero effects from Windows 7. Aero Glass technically works with Windows 10, too, although we haven't had much luck in getting any of the effects to work.

**55 TRY A NEW SHELL**  
The most radical change you can make to Windows is to

replace the default shell with another one. One of the simplest to deploy is Cairo (<https://cairodesktop.com>) – during installation, leave the default settings, so it installs alongside File Explorer, not in place of it.

**56 SET UP APPS**  
After installation, Cairo opens the App Grabber to enable you to choose which app shortcuts to add to the Programs menu at the top of the screen. Drag those you want into the left-hand pane, then click "Continue" to place them in subfolders

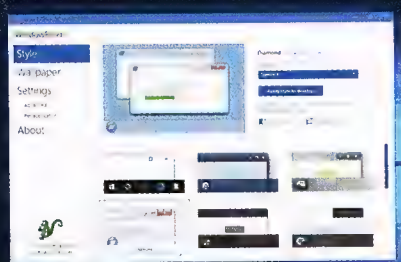
such as "System Tools" or "Office." Click "Finish."

**57 USE THE MENU BAR**  
Cairo's menu bar offers shortcuts to Programs, Places (user folders, This PC, Program Files, and the Recycle bin), Documents, and Downloads. There are various system tools and shortcuts on the right – click "<" to reveal your Taskbar notification area icons. Click the Cairo menu button in the top-left corner for a slimmed-down Start menu (plus access to Cairo's settings, or choose "Exit Cairo" to return to the regular desktop).

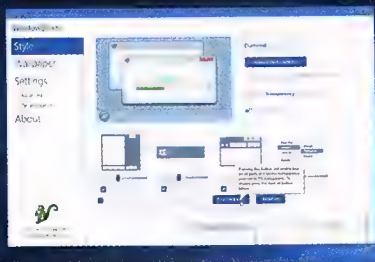
**58 NAVIGATE FOLDERS WITH CAIRO**  
You'll see a list of files and folders on the desktop that correspond to those that are on your desktop. A floating bar enables you to change the folder shown using the navigation buttons to move up and down the folder tree, go back to the "home" desktop folder, or jump to a different folder.

**59 CAIRO'S DOCK**  
Last, but not least, is Cairo's dock – its replacement for the Taskbar. It exclusively displays shortcut icons and open windows – click to open, right-click for more options, or "=" to open Task View for a preview of open windows.

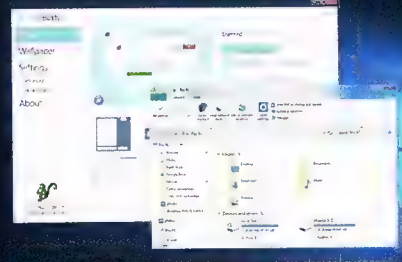
## 60 TRANSFORM YOUR DESKTOP WITH WINDOWBLINDS



**A DOWNLOAD AND INSTALL**  
Download the trial version of WindowBlinds from [www.stardock.com/products/windowblinds](http://www.stardock.com/products/windowblinds) – after the program has installed, choose the 30-day trial, and enter your email address. Once activated, pick a style from the "Style" section of the program to preview it.



**B MODIFY SKIN**  
Click "Modify Style" to make changes – work through the "Colors," "Transparency," "Textures," and "Fonts" sections to customise it exactly the way you want it to look. Aching to recreate the old Windows 7 glass-like style? Select "Diamond" and choose "One click blur" under "Transparency."



**C APPLY NEW SKIN**  
Once you've finished making your changes in WindowBlinds, click "Stop modifying" followed by "Apply style to desktop." After a short pause, you'll see the Windows desktop update. Continue making tweaks – increase transparency using the sliders, for example – and apply them in real time. ■





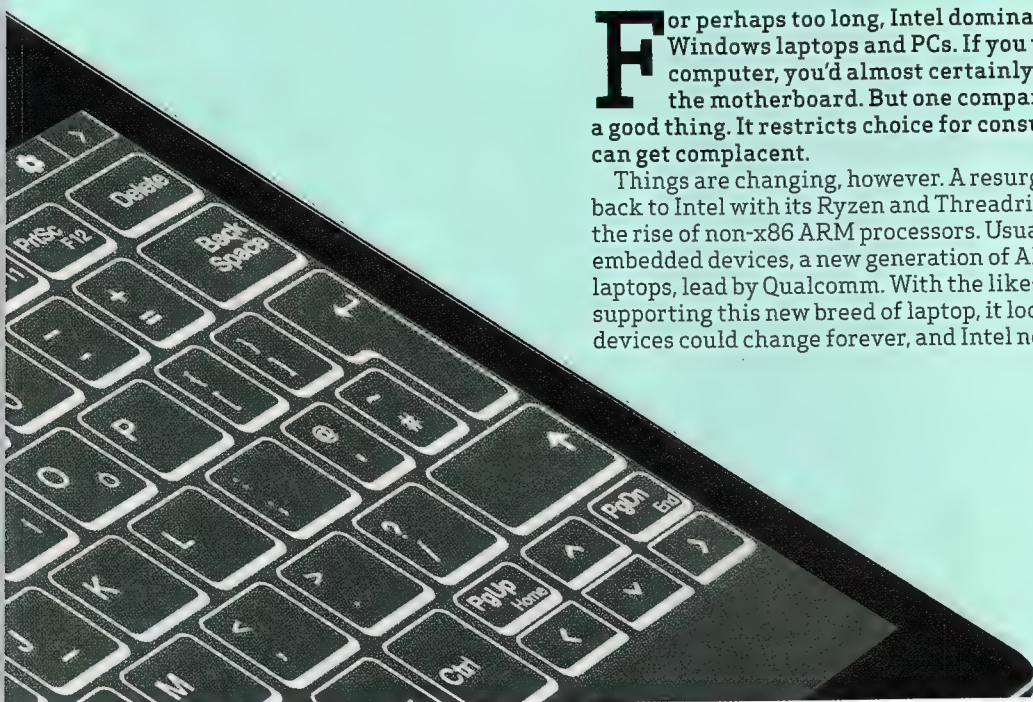


# QUALCOMM AND THE RISE OF NON-X86 WINDOWS

Intel is feeling the squeeze from its ARM rivals, says Matt Hanson.

**F**or perhaps too long, Intel dominated the CPU market for Windows laptops and PCs. If you were buying or building a new computer, you'd almost certainly be slotting an Intel chip into the motherboard. But one company having such dominance isn't a good thing. It restricts choice for consumers, and the market leader can get complacent.

Things are changing, however. A resurgent AMD is bringing the heat back to Intel with its Ryzen and Threadripper CPUs, and we're also seeing the rise of non-x86 ARM processors. Usually found in mobile and embedded devices, a new generation of ARM processors is now powering laptops, lead by Qualcomm. With the likes of Microsoft and Lenovo supporting this new breed of laptop, it looks like the way we use those devices could change forever, and Intel needs to adapt – or die.







Qualcomm is a US company that used to be best known for creating telecommunication equipment. Its Snapdragon System on Chip (SoC) platform powered some of the most popular smartphones in the world. Part of the appeal of Snapdragon-powered smartphones was that, thanks to Qualcomm's hardware, these devices could handle many tasks that we used to use computers for. Suddenly, we were checking emails, browsing the web, and posting cat pictures on social media using our smartphones. Laptops began to fall out of vogue.

For the past 40 years, laptops have pretty much kept the same form factor. Sure, 2-in-1 laptops with 360-degree hinges and removable keyboards (such as Lenovo's Yoga series or Microsoft's Surface Laptop respectively), offered slightly different spins on the tried-and-tested laptop design, but on the whole, laptops hadn't changed much. You got a screen and keyboard in a clamshell design, and they were usually powered by Intel processors and integrated graphics. They became safe and boring, especially compared to high-end smartphones, and the laptop market declined accordingly.

However, at Computex 2017, Qualcomm and Microsoft announced a new breed of laptop, powered by the Snapdragon platform. Instead of smartphones taking features from laptops, we saw laptops from manufacturers such as HP, Lenovo, and Asus taking inspiration

from smartphones.

This first wave of Windows on Snapdragon (WoS) devices were built on the octa-core Snapdragon 835 SoC. Originally designed for flagship smartphones such as the Samsung Galaxy S8, the Snapdragon 835 was a 64-bit ARM processor that used Qualcomm's in-house Kryo 280 cores, and was built using Samsung's 10nm

FinFET processor.

These ARM-based laptops brought features we'd come to take for granted on smartphones, such as almost instant boot times, always-on cellular data connection, and battery lives far in excess of anything an Intel-based x86 laptop was capable of, with claimed battery lives of over 20 hours.

The Snapdragon 835 SoC also ran a lot

## Software support

Perhaps the biggest hurdle for non-x86 laptops is software support, because the vast majority of PC software is written for 64-bit and 32-bit Intel and AMD hardware.

In the past, this has meant that laptops running on non-x86 hardware have been restricted by what kind of hardware they can use. However, that is all changing. Microsoft has been pushing Windows on Snapdragon and Windows on ARM development, which are versions of its Windows 10 operating system that are designed for non-x86 hardware. It brings a Windows desktop experience you'd expect on a laptop – and there's a growing number of apps on the Microsoft Store that can run on these devices. There are still noticeable absences, but Microsoft is making it easier for developers to recompile their win32 or Universal Windows Apps to become ARM64 apps, so they can run on 64-bit ARM hardware. It is also introducing emulation for win32 apps to run on ARM hardware – which will expand the software available for Windows on ARM devices without impacting performance.

If Apple does move to its own non-x86 hardware for MacBooks, we should see the company port its apps to the new hardware (and encourage third parties to do the same). We know that Apple is working on Project Catalyst, which will allow developers of iOS apps for iPhone and iPads to easily convert their apps to work on macOS. If future Macs run on similar architecture to Apple's mobile devices, Project Catalyst will ensure there is a wide variety of software ready to go.

The growth of web apps, which can run through a web browser, also means that many traditional restraints for non-x86 hardware will no longer apply.



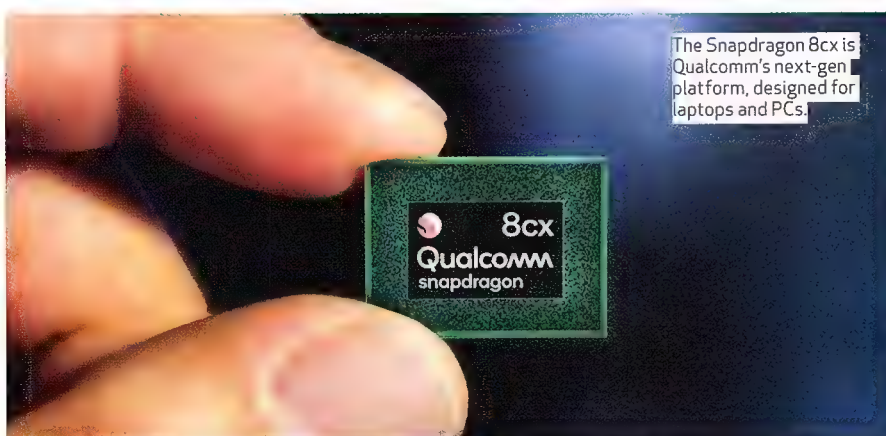
## Intel's response

The rise of non-x86 laptops, especially ones powered by Qualcomm, has inevitably lead to Intel shaking off its complacency and moving to counter the threat of this new hardware

While it hasn't explicitly admitted so, its Project Athena initiative is a response to the rise of non-x86 hardware. If you've not heard of it, Project Athena is a laptop design initiative that will see Intel work closely with a number of laptop manufacturers to help shape the future of laptops by offering products that are smarter, faster (thanks to 5G), and more power-efficient – so battery lives are much longer. If always-on, always-connected laptops with long battery lives sounds familiar, it's because that's exactly what Qualcomm's Snapdragon platform offers. While Intel's focus on those aspects could be coincidental – or simply a response to what customers are now wanting from laptops – we can't help but think it is also driven by the threat posed to its market share by this new breed of laptop.

Intel has suggested that initial Project Athena laptops could release as early as late 2019. However, if that's the case, then we wouldn't expect to see any Project Athena-certified laptops until very late this year.

According to Intel, "the next wave of Project Athena designs" will come in "2020 and beyond," so expect to see Project Athena laptops from manufacturers, such as Asus and Acer, next year. Whether or not they can compete with Windows on Snapdragon laptops remains to be seen. But if Intel can come up with laptops that feature the best of what Snapdragon laptops offer, without the compromises – due to them still running on Intel hardware – it could have a hit on its hands.



"This leap in performance for the Snapdragon platform should get Intel worried. But what comes after it could really make Team Blue sweat"



cooler than x86 hardware, which meant manufacturers could forgo fans – leading to thinner, lighter, and quieter laptops.

The HP Envy x2 and Asus NovaGo were two of the first Snapdragon-powered laptops, and they certainly delivered on some promises – battery lives lasted around 20 hours, and the always-on 4G cellular data connection meant you could instantly get online almost anywhere without having to find and log into Wi-Fi networks (good for the security-conscious, as it meant you could avoid potentially compromised Wi-Fi hotspots).

However, they were far from perfect. When it came to performance, these non-x86 laptops couldn't keep up with Intel and AMD-powered machines. While Microsoft worked hard to make a version of Windows 10 that worked on non-x86 gear, it struggled with even simple tasks.

Worse, these laptops were incredibly expensive, considering the level of performance you got. While they should have been priced around the same as a low-end Chromebook, they ended up costing closer to \$1,000 – and for that money you could buy a high-end Intel laptop that would blow the Snapdragon-powered device out of the water.

Still, they were doing something new, and they hinted at the possibilities of non-x86 Windows laptops.

Qualcomm continued to refine its Snapdragon platform for laptops and smartphones. The octa-core Snapdragon 845 came out in December 2017, and brought with it both performance and battery improvements.

In 2019, Qualcomm produced its best Snapdragon SoC yet with the Snapdragon 850 platform. It brought a 30 percent increase in performance compared to the previous generation, and offered 25 hours of battery life. It also came with an improved modem for faster 4G LTE speeds, thanks to the Snapdragon X20 LTE modem, which offers peak downloads of 1.2 gigabits; it's also better at performing in areas of weak signal.

The boost in performance also brought support for 10-bit HDR video content and surround sound. While these are things we've come to take for granted in modern laptops, previous WoS notebooks lacked the oomph to deliver a decent experience.

So, although earlier Snapdragon-powered laptops didn't do anything to challenge the dominance of x86 hardware, the improvements promised by Snapdragon 850 could give the likes of Intel and AMD reason to worry.

What's really exciting is that in our experience, the Snapdragon 850 really does deliver on those improvements. We've been playing with the Lenovo Yoga C630, and the improvements over the HP Envy x2, which runs on the Snapdragon





Snapdragon-powered laptops have SIM card trays for mobile connectivity.



The Lenovo Yoga C630 is one of the best Snapdragon-powered laptops out there.

## Intel Project Athena features

To release a laptop as part of Project Athena, manufacturers will have to meet certain specifications, and this is what Intel has revealed so far....

**5G connectivity:** One of the biggest features of Project Athena will be 5G connectivity. This means that every Project Athena laptop will come with the ability to connect to 5G cellular networks (via a SIM card).

**Longer battery life:** Improving the battery life of laptops has been a constant struggle for manufacturers. With laptops getting ever thinner, the space to add batteries shrinks as well. Project Athena aims to drastically improve the battery life of laptops, with times between charges of around nine hours, which is a lot longer than modern Intel-based laptops. However, Snapdragon-based laptops have seen battery-life figures of beyond 24 hours.

**Instant-on:** Smartphones and tablets have spoiled us when it comes to devices that power up almost instantly, and Project Athena aims to bring that to Windows-based laptops and Chromebooks with Intel hardware inside. Again, Windows on ARM devices already manage this, and they also remain connected when in sleep mode, so emails can continue to be downloaded, for example, which means that when you open up the laptop, your emails are already there. We hope – and expect – Project Athena will offer similar functionality.

**Intel hardware:** We also expect Intel to set minimum hardware specifications, such as including SSD storage and support for Wi-Fi 6, the latest wireless networking technology.

**Price-wise,** we expect Intel Project Athena laptops to be pitched at the higher end of the market – much like when it created the Ultrabook category of laptops. However, Intel has talked about how Project Athena will cover a range of laptop types – and that Athena laptops will run Windows 10 and Chrome OS. Coupled with the fact that Google is one of the Project Athena partners, it looks like we'll be getting Project Athena Chromebooks – which means there's a good chance we'll see affordable Athena laptops as well.

835, are very impressive.

In Geekbench 4, the HP Envy x2 scored 770 (single-core) and 3,116 (multicore), while the Yoga C630 easily surpasses it with a single-core score of 2,291 and a multicore score of 7,101. In our day-to-day experience using both laptops, we were seriously disappointed with the Envy x2, but the Yoga C630 managed what previous Windows 10 on ARM laptops failed to do, combining smartphone-like connectivity and battery life with performance that's not too far off x86 laptops.

This leap in performance for the Snapdragon platform should get Intel worried. But what comes after it could really make Team Blue sweat.

## THE FUTURE OF SNAPDRAGON

While the Snapdragon 850 represented a big leap in making non-x86 laptops a more viable alternative, it was still held back by one major compromise: The 850 SoC was first and foremost a chipset for smartphones and tablets that is also used for laptops. However, in 2019, Qualcomm announced the Snapdragon 8cx, which will be the first chip it's produced that is designed specifically for laptops and computers. Without the constraint of it being a smartphone chip retrofitted for laptops, the 8cx has the potential to really make non-x86 laptops mainstream.

Qualcomm also beat AMD and Intel to the punch, because the 8cx contains the first 7nm processor for laptops and Windows devices: the Kryo 495. Meanwhile, Intel is still working on its 10nm architecture.

That's a pretty big PR blow Qualcomm has landed on its competitors, but not only does the smaller architecture look good on paper, but it should bring some real performance benefits as well.

It's based on ARM's big.LITTLE compute system, which combines slower processor cores with faster and more power-hungry cores, and switches between them, depending on the workload, to help maximize battery life without impacting performance, and will support up to 16GB of DDR4 memory, NVme SSDs, and Gen 2 USB-C 3.1.

For owners of Intel-powered laptops, that kind of feature list might simply elicit a small shrug – after all, x86 laptops have had those features for a while now. However, it's another step toward Snapdragon and other ARM-powered laptops challenging the current dominance of Intel-based hardware.

The 8cx's Adreno 680 graphics card also offers a decent leap in performance – including DirectX 12 support – so we could even see Snapdragon laptops that are capable of a little light gaming as well. It can also apparently power two connected 4K HDR monitors, too.

However, arguably the Snapdragon 8cx's most important feature is its



support for 5G mobile internet. The speeds and low latency afforded by the emerging cellular data technology could have huge implications for how we use our computers. For instance, it could mean that we would be able to use our 5G laptops to stream games from services such as Nvidia GeForce Now or Google's upcoming Stadia service – so the lack of a powerful GPU wouldn't even be an issue. The idea that Snapdragon 8cx-powered laptops could become lightweight gaming machines that can play games at full graphical settings – and also have battery lives of over 20 hours – is certainly an incredibly exciting one.

At Computex 2019, Qualcomm and Lenovo announced that they were working on "Project Limitless," which will be the first ever 5G laptop – and it will run on the Snapdragon 8cx platform.

According to Johnson Jia, senior vice president of Lenovo's PC Business Group, "Lenovo 5G PCs built on the Snapdragon 8cx 5G compute platform will feature ultra-low latency, remarkable performance, battery life, and 5G connectivity that will revolutionise the way we work and play."

That's a big promise, and while we don't know much more about Lenovo's Project Limitless, we should hopefully find out more later this year.

## IS THE TIDE TURNING?

What the latest Snapdragon platform (and the future 8cx) demonstrates is that ARM-based laptops are finally viable propositions. They are no longer over-priced and under-performing curios, but laptops that offer genuine alternatives to x86 machines.

Could that lead to more laptop manufacturers looking at leaving Intel and AMD, and using ARM hardware in their products instead? Perhaps. Intel hasn't been doing a fantastic job of keeping manufacturers onside, due to a number of high-profile security flaws in its chips. Meltdown and Spectre made the headlines last year, and ZombieLoad was recently discovered, leading to many manufacturers and software developers having to scramble to provide patches to mitigate against the vulnerabilities.

Not only do these flaws annoy manufacturers, who feel they have to work to fix Intel's problems, but most of the fixes involve disabling Hyper-Threading, a feature that generates virtualised processor cores for improved multitasking, and that has led to some drastic performance impacts after the patches are applied.

For example, Apple revealed that, with the ZombieLoad patch installed, there could be performance drops of up to 40 percent – which would particularly impact Macs with

A Qualcomm Snapdragon 8cx laptop reference design.



multicore processors.

Not only will this annoy customers, who are seeing their expensive devices perform worse, but it's not a good look for the manufacturers, either. If your Mac suddenly starts running slow, you're likely to blame Apple before you blame Intel.

Speaking of Apple, rumors have continued to grow that the company is looking to part ways with Intel and produce its own custom ARM-based chips in 2020. Apple is a company that likes to keep control over all parts of its hardware, so we think this is an increasingly likely possibility. Not only will the company have been nonplussed about having to throttle the performance of its Macs due to ZombieLoad (which does not affect AMD and ARM processors), but it also recently suggested that the drop in Mac sales was due to "processor constraints in the March quarter, leading to a five percent revenue decline compared to last year." The fact that Tim Cook himself was all but calling out Intel doesn't bode well for the relationship between the two companies.

If a company as big as Apple ditches Intel for ARM, we could easily see other companies following suit.

Another laptop manufacturer that is set to move from Intel to its own processors for its laptops (but for very different reasons) is Huawei. You've probably seen the news about the US government's blacklisting of the Chinese company over espionage fears, and it has resulted in most US companies ceasing business with it. This means that Intel will no longer be supplying processors for Huawei's MateBook range of laptops. This has forced the company to look into creating its own processors, which we



ZombieLoad: the latest bug to hit Intel CPUs.

think will likely be non-x86. Earlier this year, Huawei showed off its Kunpeng 920 CPU, which is an ARM-based CPU that it claims is the highest-performance ARM CPU in existence.

We would think that Huawei migrating to ARM for its laptop processors would be a no-brainer in light of its recent troubles. The only problem is that ARM has also said that it will stop working with Huawei. This could have huge implications for both companies – though especially Huawei, which will need to look at building its own RISC-based CPU from the ground up.

So, the future of non-x86 Windows (and Mac) laptops certainly looks bright. While we don't expect Intel-based machines to suddenly disappear from the laptop landscape altogether, the fact that we're going to be given more choice is certainly welcome. The fact that these ARM-based alternatives are bringing some genuinely innovative new features to the rather staid laptop form factor is also to be celebrated – and with Intel's once unassailable dominance now under threat, we're looking forward to seeing how the chipmaker responds. All of a sudden, laptops are exciting again.



"The thought of no longer seeing a benefit from overclocking makes me both happy and sad at the same time."



# System News

Zen 2 saw the consolidation of AMD's resurgence, but Mark Williams wonders if it's also sounded the death knell of overclocking?

**W**hen the reviews of the new Ryzen 3000 series CPUs started coming out, one of the more exciting things I was looking forward to reading about was the overclocking potential. A newer, smaller process technology usually allows for not only higher stock clocks but also higher peak overclocking potential. With Ryzen 3000 we definitely saw higher stock and boost clocks over Ryzen 2000, to the tune of 200 - 300MHz which - combined with the 15% higher IPC - was the perfect one-two punch AMD needed to stand toe-to-toe with Intel's product stack and severely pour the pressure on.

However, the initial overclocking results showed something remarkable that I'd never seen before; the overclocked results on average were slower than the stock configuration! Now, you could've put that down to immature BIOSes, the new Zen 2 architecture, or everyone needing to learn how to overclock it correctly, as it's a more complicated beast thanks to its chiplet design. But even now, a couple of months after launch, overclocking Ryzen 3000 doesn't result in a straight win scenario all the time.

Sure, you can overclock all the cores of the 3900X, for example, to 4.3GHz but doing so locks single or lightly threaded speeds to the same level, down from the stock 4.6GHz boost speeds. Meaning that unless your workloads always utilise all CPU cores under load, you're not always going to get the best out of the processor for every situation. That's with ambient cooling with air coolers and water cooling. Chilled cooling or using liquid nitrogen (LN2) allows the 3900X to clock all the way up to 5.2GHz and beyond, but as cool as those solutions are (pun intended) that's not a normal use-case.

With Ryzen 3000, AMD has fine-tuned the boost and overdrive feature sets so well that its CPUs are now acting more like GPUs have been for the past few generations; they're now temperature limited. As a result, rather than spending a fortune on a good overclocking motherboard, it could actually work out better to simply get a better cooler instead and gain yourself 100 - 200MHz higher boost clocks without having to do any overclocking. As with any modern GPU, if there's spare thermal headroom it'll boost to higher speeds automatically.

## SHOP TALK

For the average enthusiast, how do you see the future of overclocking unfolding in the coming years?

### John, TI Computers:

"The benefits of overclocking have definitely been bottlenecked due to the scalability of both Intel and AMD platform. In some platforms, the single threaded performance may even drop after a manual overclock, for example on the new Ryzen 3000 platform. Pretty much what you see on the GPU side since roughly a decade ago.

What we do see is the potential of overall system optimisation. Understanding there is not much more room to push in terms of the actual operation frequency, the advanced techniques to tune timing, delay, energy efficiency and fan curve will be the next focus. This is similar to how the graphics card has evolved over the last decade, except it is in on the shoulders of us system builders. I don't believe the future of overclocking has come to an end. Rather, I personally consider this a brand-new start."

This leads on to an interesting thought, is this the beginning of the end for overclocking? If manufacturers design their silicon to automatically extract the most performance possible given that they have all sorts of situational information from the hundreds of power and temperature sensors now built in to these products to what the VRM temperatures are, when you think about it, it begins to look archaic and poor design when a processor doesn't automatically take advantage of spare power or thermal headroom to give you more performance, as has been the case ever since CPUs began.

Chilled and LN2 overclocking will still have its place at the extreme high end, but for regular folks using ambient cooling solutions, this could be the beginning of the end of extracting free extra performance out of your processors.

The thought of no longer seeing a benefit from overclocking makes me both happy and sad at the same time. With AMD pushing performance so hard it'll be interesting to see if Intel follows suit to extract the most out of its chips too.



# Market Snapshot

A sampling of PC systems available this month.



## JW Computers GMR Archer 1650

\$1,339 [TINYURL.COM/APC472JWC](https://tinyurl.com/APC472JWC)

This cheap and cheerful system is surprisingly powerful given that it's tickling the bottom end of entry level gaming systems. The CPU is quite adequate for any game currently available, however pairing it with the GTX 1650 would be the bottleneck here. Especially with the 4GB of VRAM you'd only be looking at 1080p gameplay. As a side note, Nvidia in its wisdom didn't upgrade the NVENC engine on the 1650 compared to the faster 1660 and higher cards, so streaming/recording quality won't be as good if you're hoping to do that. The rest of the system is quite reasonable given the super low price, though the installed DDR4 2400 is below the CPU's stock 2666MHz specifications.

**KEY SPECS:** CPU: Intel Core i5 9400F **COOLER:** OEM **MOTHERBOARD:** Asus TUF B360-PRO **GRAPHICS:** Gigabyte GeForce GTX1650 4GB OC **MEMORY:** Kingston HyperX Fury 8GB DDR4 2400 **STORAGE:** WD Green 240GB M.2 SSD, Seagate Barracuda 1TB HDD **POWER SUPPLY:** Thermaltake Litepower 500W **CASE:** CoolerMaster MasterBox TD500 RGB.



## Allneeds Computers MSI Vampyr RGB

\$1,799 [TINYURL.COM/APC472ANC](https://tinyurl.com/APC472ANC)

This is an interesting build due to it not being a popular combination. With this system AllNeeds has tried to keep the costs down by going with AMD's fastest APU instead of a regular CPU and going with a basics-only motherboard.

The combined savings appear to have then been funnelled into the graphics card and higher spec memory. This gives the system the capability of smooth 1440p gameplay. The higher spec memory is good to see as Ryzen CPUs love the extra speed. In the long run the CPU will be the bottleneck, but with the AM4 socket, that'll be an easy future upgrade.

**KEY SPECS:** CPU: AMD Ryzen 5 3400G **COOLER:** OEM **MOTHERBOARD:** Asus B450M Pro-VDH Plus **GRAPHICS:** MSI Radeon RX 5700 8GB **MEMORY:** Trident Z RGB 16GB 3000MHz DDR4 RAM **STORAGE:** Crucial MX500 250GB M.2 SSD, Seagate Barracuda 2TB HDD **POWER SUPPLY:** Thermaltake Smart Pro RGB 650 W **CASE:** MSI Vampyr.



## TI Computers Dream 9700K

\$2,520 [TINYURL.COM/APC472TIC](https://tinyurl.com/APC472TIC)

Compared to this month's PC Case Gear system, which also sits in the same price category, this machine is technically the better for gaming. The higher clocked and overclockable 9700K will help keep your frame rates higher on average. It sports double the SSD capacity and a higher rated power supply.

With the RTX 2070 Super powering the system, multi-screen setups or high refresh rate 1440p monitor setups shouldn't be much of an issue. This is the sort of system you look for when you're serious about playing triple-A games daily without going overboard on the price.

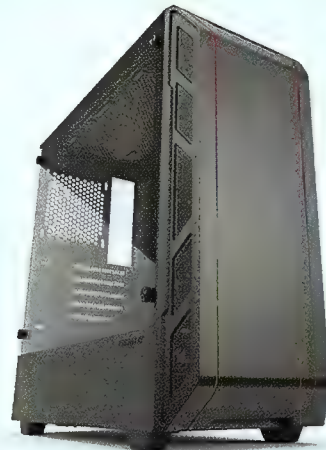
**KEY SPECS:** CPU: Intel i7 9700K **COOLER:** Cooler Master Super Cooler **MOTHERBOARD:** Asus Prime Z390-P **GRAPHICS:** GeForce RTX2070 Super 8GB **MEMORY:** 16GB Kingston DDR4 3200Mhz **STORAGE:** 512GB Intel M.2 SSD, 2TB Seagate HDD **POWER SUPPLY:** Corsair 750W **CASE:** DeepCool Matrexx 55.

## PC Case Gear Fusion 2070 Super

\$2,499 [TINYURL.COM/APC472PCC](https://tinyurl.com/APC472PCC)

Competing squarely with the TI Computers system this month on price, this system comparatively loses out on half the SSD capacity and 100W of PSU wattage, but gains double the CPU thread count. Given that the 3700X at the time of writing is cheaper than the 9700K, it's difficult to see why this system costs more. As a result, this feels at least \$100 - \$200 overpriced/under-specced. The CPU is great not only for gaming but productivity too, but considering how cheap SSDs are these days, for the price a 500GB model should've been included instead. A great system, capable of 4K (with DLSS) gaming, but the price difference is hard to justify. Unless you want RGB, because that seems to be where the extra costs were sunk into on this system. It does do the shiny thing well if that's what you're after.

**KEY SPECS:** CPU: AMD Ryzen 7 3700X **COOLER:** Wraith Prism **MOTHERBOARD:** Gigabyte B450 Aorus M **GRAPHICS:** Gigabyte GeForce RTX 2070 Super Gaming OC 8GB **MEMORY:** Corsair Vengeance RGB Pro 16GB 3200MHz DDR4 **STORAGE:** Adata XPG SX8200 Pro 256GB M.2 SSD, Seagate Barracuda 2TB HDD **POWER SUPPLY:** Phanteks PH-P650GS 650W **CASE:** Phanteks Eclipse P350X.





# PC blueprints

The APC team's picks for a part-by-part perfect PC build to suit your budget.



## PARTS LIST

| PART               |                                                         | PRICE   |
|--------------------|---------------------------------------------------------|---------|
| CASE               | BITFENIX NOVA TG                                        | \$73    |
| PSU                | CORSAIR VS450 80+ WHITE 450W <b>NEW</b>                 | \$49    |
| M/BOARD            | ASROCK B450M R4.0 AM4                                   | \$109   |
| CPU                | AMD RYZEN 5 2600X <b>NEW</b>                            | \$249   |
| GPU                | EVGA GEFORCE GTX 1660 XC BLACK 6GB <b>NEW</b>           | \$369   |
| RAM                | 8GB (2X 4GB) KINGSTON HYPERX FURY @ 2,666MHZ <b>NEW</b> | \$89    |
| SSD                | 120GB CRUCIAL BX500 2.5-INCH                            | \$30    |
| HDD                | 1TB WD BLUE 3.5-INCH HDD                                | \$59    |
| OS                 | UBUNTU DESKTOP LINUX 18.04 LTS 64-BIT                   | \$0     |
| APPROXIMATE PRICE: |                                                         | \$1,027 |

Changes across the board were minimal for the budget build this month, so it's unlikely you'll see much difference in performance. The key alteration was the switch from the conventional Ryzen 5 2600 to the 2600X version, with its expanded overclocking potential. The 2600X was inexplicably cheaper this month, even though neither item was on sale with any of the big online retailers. The max boost frequency is 0.3GHz higher, and the overall performance should be slightly superior to last month's setup. The 2600X also comes with a beefier cooling solution; the AMD Wraith Stealth is replaced by the taller Wraith Spire. We've also shifted from Gigabyte to EVGA on the GPU front; we're down from two fans to one, and the boost clock is a little less impressive, but the EVGA GTX 1660 XC Black is quieter and currently the cheapest GTX 1660 card on the market.

## PARTS LIST

| PART               |                                                | PRICE   |
|--------------------|------------------------------------------------|---------|
| CASE               | FRACTAL DESIGN MESHIFY C                       | \$149   |
| PSU                | 550W COOLER MASTER MASTERWATT 550 80+ BRONZE   | \$79    |
| M/BOARD            | MSI B450M GAMING PLUS <b>NEW</b>               | \$129   |
| CPU                | AMD RYZEN 7 2700                               | \$315   |
| COOLER             | AMD WRAITH MAX <b>NEW</b>                      | \$59    |
| GPU                | SAPPHIRE RADEON RX 5700 8GB <b>NEW</b>         | \$589   |
| RAM                | 16GB (2X 8GB) CORSAIR VENGEANCE LPX @ 3,200MHZ | \$139   |
| SSD                | 250GB SAMSUNG 970 EVO PLUS M.2 PCIE            | \$119   |
| HDD                | 1TB WD BLUE 3.5-INCH HDD                       | \$59    |
| OS                 | WINDOWS 10 HOME 64-BIT OEM                     | \$140   |
| APPROXIMATE PRICE: |                                                | \$1,777 |

We didn't really want to admit it, but yes, an AIO cooler for this build was overkill. We're out to make some savings this month, and a pricey cooling solution represented the perfect place to trim the fat in this build. To that end, we've opted for AMD's high-end air cooler, the Wraith Max, which comes with RGB lighting and near-silent fan operation, while still providing sufficient heat dissipation for all but the most savage of overclocking attempts. We're putting that cooler on to a different board, too: the MSI B450M Gaming Plus, a slight upgrade from last month's B450-A and it's a bonus \$14 cheaper. The key change here, though, is going from Nvidia to AMD with our graphics card. For no extra cost, the RX 5700 provides slightly better performance and an extra 2GB of VRAM for your system. Right now, it comes bundled with a three-month pass for Xbox Game Pass on PC, too.





#### UPGRADE OF THE MONTH

### Sapphire Radeon RX 5700

\$589, [WWW.SAPPHIRETECH.COM](http://WWW.SAPPHIRETECH.COM)

The RX 5700 XT might have been the star AMD card this issue, but its little brother shouldn't be disregarded. It's a quality GPU that modestly outperforms the GeForce RTX 2060 for the same price. That's all that needs to be said; gains only range from 5–15 percent with various games and graphical settings, but that's an improvement that typically costs the same. Sapphire is a trusted manufacturer of Radeon GPUs – XFX and Asus are good options, too.

"We're out to make some savings this month, and a pricey cooling solution represented the perfect place to trim the fat in this build."

At the time of writing, we didn't have access to the RTX 2080 Super cards – expect to see one in this build next issue. For now, though, Zotac's twin-fan offering of the original RTX 2080 is significantly discounted, so we'll be swapping to that from last month's MSI GPU saving us \$150. Given the 2080 Super will have the same baseline price point as the 2080, and won't be likely be discounted anytime soon, snapping up a cut price high-end card like this is a good call right now.

While the Gigabyte Aorus RGB SSD remains great value, we decided to use the spare cash from the GPU to splash out, going for Samsung's 970 Evo M.2 drive. While we lost 12GB of storage, Samsung remains the king of SSD write speeds, netting us an extra 300MB/s of maximum transfer rate for just \$20 extra.

As usual, there's no call to trade out our CPU and motherboard here. Asus's Prime X399-A has been one of the best-value X399 boards in the game for a while, and Threadripper prices are staying stalwart, even in the face of Ryzen 9. Upgrading the processor in this build would throw a significant price hike into the overall system; bear in mind that if you've got the extra \$320 to upgrade to the 2970WX, splashing out at extra \$100 or so on a superior motherboard is almost always a worthy investment. ■

#### PARTS LIST

| PART               |                                           | PRICE   |
|--------------------|-------------------------------------------|---------|
| CASE               | NZXT H700I                                | \$219   |
| PSU                | 850W CORSAIR TX-M SERIES 80+ GOLD         | \$179   |
| M/BOARD            | ASUS PRIME X399-A                         | \$419   |
| CPU                | AMD THREADRIPPER 2950X                    | \$1,179 |
| COOLER             | COOLER MASTER MASTERLIQUID ML360 RGB AIO  | \$130   |
| GPU                | INNO GEFORCE RTX 2080 8GB OC <b>NEW</b>   | \$899   |
| RAM                | 32GB (2X 16GB) G.SKILL RIPJAWS @ 3,200MHZ | \$299   |
| SSD                | 500GB SAMSUNG 970 EVO M.2 NVME <b>NEW</b> | \$168   |
| HDD                | 2X 3TB SEAGATE BARRACUDA COMPUTE          | \$238   |
| OS                 | WINDOWS 10 HOME 64-BIT OEM                | \$140   |
| APPROXIMATE PRICE: |                                           | \$3,870 |





# Home on the RAID

Build your own NAS box, with stuff you have lying around, and the magic of open source..

**L**ast month we ran a simple tutorial on creating your own NAS, and in this issue we're diving in deep with a full build, because we know how popular NAS devices are and this is a project we really want to get stuck into. Off-the-shelf NAS units are easy to come by, but they're often underpowered, overpriced, or otherwise disappointing. Many of them run some kind of Linux (usually on quite modestly powered ARM hardware), and it's pretty straightforward to build a Linux box, and cram it with as many hard drives as geometry permits. You may even have enough spare parts lying around to get most of the way there (we did). You don't need anything special hardware-wise (4GB of RAM and a CPU sometime from the last decade is fine), but several large hard drives help. Many consumer-level NAS devices come in attractive small form factors, and thanks to their low power consumption, don't require noisy cooling. So, we thought we'd try our hand at mimicking this.

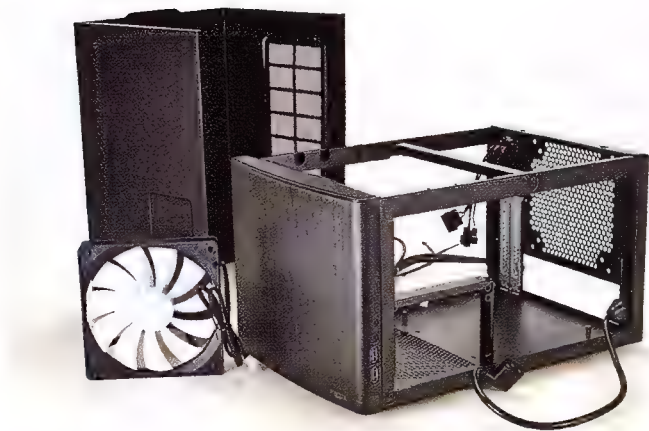
If the prospect of using Linux makes you cringe, don't worry – we're going to use the fantastic OpenMediaVault, which (all going to plan) means you won't have to touch a command line, and everything can be controlled from a friendly web interface. Next-gen filesystems, RAID, and LVM don't need abstruse incantations (or sacrifices) at the terminal. Best of all, OpenMediaVault can be customised and added to as much as you want. Read all about it at [www.openmediavault.org](http://www.openmediavault.org).

The Plex extension (available via the [OMV-Extras.org](http://OMV-Extras.org) repository) is particularly great, and will turn your NAS into a full-fledged DAAP media server. Beyond that, OMV can run Docker images, so you can host any popular Linux application you like, whether it's Nextcloud, Mastodon, BitTorrent, or anything else you care to name. OMV is also based on Debian Linux, so you can do pretty much whatever you'd do there with it.



REUSE AND RECYCLE

Fractal Design was good enough to send us its Node 304 case for this build, which may be an aging model, but we were glamored by its teeny-weenyness. It's surprisingly difficult to find an ITX form factor case that can fit lots of hard drives in it; the Node 304 has room for six 3.5-inch drives, but is no bigger than two shoeboxes, so is ideal for hiding under the stairs. It's a little tricky to work with if you have a large heatsink, but it has excellent airflow, with two fans at the front and a large fan at the back. It's always tempting to opt for cheaper components, or even second-hand ones – and that's what we did, using an MSI-88X AC motherboard and an Athlon A10-7800K APU, circa 2014. Integrated graphics are certainly de rigueur here, because this device will probably run headless for most of its life. We used three 1TB Hitachi drives and a spare 240GB SSD for OMV. This is entirely overkill, because the initial installation is only around half a gigabyte, but we can use that space for something later. To get OMV installed, we used the cross-platform Etcher utility (<https://etcher.io>) to write the ISO to a USB stick. You can download said ISO from the OMV website. We got OMV to set our drives up as a RAID 5 array, having a total capacity of 2TB, and the ability to rebuild itself if any one of the drives fails. Power-wise, we used a Be Quiet! Pure Power 11, capable of delivering a totally unnecessary 650W. Again, we just used what was to hand, and so can you.



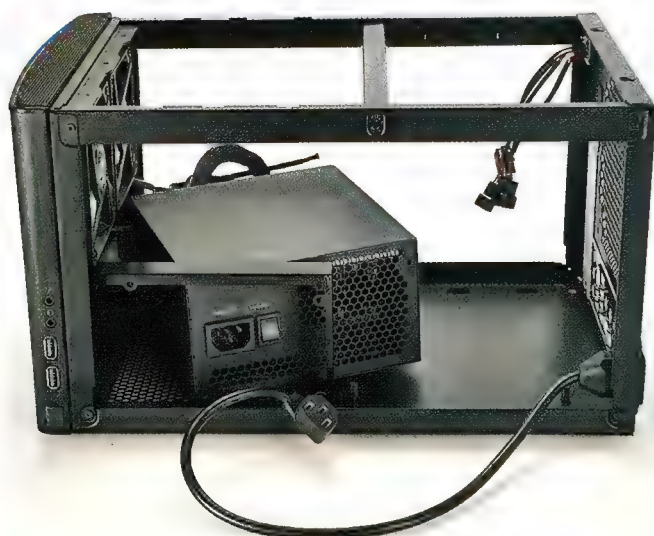
**1 CASE IN POINT** The Fractal Design Node 304 case is small, but perfectly formed. It takes a little bit of deft fingerwork in places, but if you don't use a crazy tall heatsink like us, there's actually plenty of room to work with. First, remove the thumbscrews and gently slide back the case's hood, before lifting it over the chassis and putting it somewhere out of harm's reach. Next, remove the white hard drive caddies, which are each secured with two thumbscrews and a top-facing regular screw. Before you proceed, look at how the SATA, fan, and ATX connectors are arranged on the motherboard, and think about how best to route cables. If you're going to use all three drive bays, think very hard about this, because it's difficult to envisage how little space will be left to accommodate anything once they're in place. Remove the 140mm fan from the rear of the case, otherwise getting the motherboard in will be tricky at best.

| PARTS LIST     |                                       |                   |
|----------------|---------------------------------------|-------------------|
| PART           |                                       | STREET PRICE      |
| CASE           | FRACTAL DESIGN NODE 304               | \$129             |
| MOTHERBOARD    | MSI A88XI AC                          | \$120 (PRE-OWNED) |
| CPU            | ATHLON A10-7800K                      | \$80 (PRE-OWNED)  |
| CPU COOLER     | COOLER MASTER HYPER 212 BLACK EDITION | \$59              |
| GPU            | INTEGRATED                            | \$0               |
| MEMORY         | 2X 2GB CORSAIR XMS3                   | \$30 (PRE-OWNED)  |
| PSU            | BE QUIET! 650W                        | \$169             |
| STORAGE (OS)   | INTEL DC S3510 240GB                  | \$120 (PRE-OWNED) |
| STORAGE (RAID) | 3X HITACHI 1TB DRIVES                 | \$105             |
| OS             | OPENMEDIAVAULT                        | \$0               |
| TOTAL          |                                       | \$812             |



**2 A TALL ORDER** We opted to fit the CPU and heatsink before interring the motherboard in the case. This is usually the best way to do things, because it can be tricky accessing the heatsink mounting screws from outside. Unfortunately, the combination of large heatsink and small case made life a little sweary later on; the Node 304 can accommodate coolers up to 165mm high, and the Hyper 212 stands at about 160mm. You'll want to unclip the fan from the heatsink before fitting it, so that it doesn't obstruct access to the mounting screws. Depending on your CPU choice, a long screwdriver may be handy, because the mounting screws may end up pretty close to the (thoughtfully grooved) corners of the heatsink. Fitting it to the old FM2+ socket, in particular, required a little more force than we were comfortable with, but it's probably easier on newer CPU sockets. Reattach the fan, and don't forget to connect it to the motherboard.





### 3 POWER TRIP

Once again, this should be the correct order of proceedings, but it made life a little claustrophobic for us in the next step. Fit the PSU and screw it securely in place. The PSU's kettle connector is extended to the rear of the case with a well-designed right-angled cable that will lie alongside the motherboard. If your PSU's connector is close to its edge, though, this will be a bit of a tight fit. Don't be tempted to fit the PSU upside down to work around this – the resulting updraft of hot air into the case (actually aimed right at the hard drives) will properly mess up the airflow. The connector can handle being gently squished, and it may be worth connecting it before securing the PSU. Remove the central bar (or is it more of a beam?) that until recently held the drive trays in place. Fit the four motherboard standoffs in the corners, ready to support our tiny motherboard.



### 5 OUR MANY FANS

Firstly route the ATX power cable carefully alongside the heatsink and connect it to the motherboard. It looks like an alternate route is possible along the top of the PSU (beneath the front fans), but our cable was just too chunky, and didn't leave enough room to fit the drives atop it. Fit the case connectors (this can be tricky), and connect the CPU fan if you haven't already. Reattach the 140mm case fan, ensuring the orientation is correct, so it will vent hot air from the rear of the case. The two front fans connect to two of the three-pin connectors at the rear, and all connect to the PSU via the four-pin Molex connector at the back. There's a three-position switch on the case to govern fan speeds and balance temperature and noise. Make sure the cables don't interfere with any of the fans' ability to spin; secure them with the generously provided miniature cable ties if need be.



### 4 OF MEMORY AND MOBO

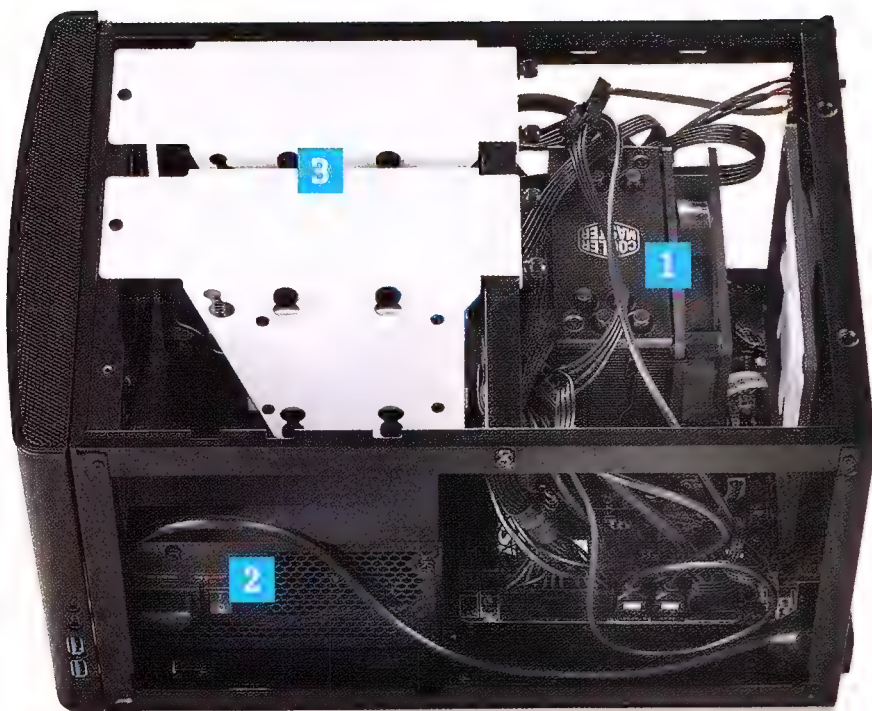
Memory is the easiest component to fry, so discharge any static you've accumulated by grounding yourself on a heating pipe (or use an antistatic strap connected to the case). Insert the RAM and ensure it's seated correctly. If your motherboard has a speaker, connect it now – its beeps may be useful if anything goes awry. Place the backplate over the mobo connectors and wrangle the motherboard into place. If your SATA data connectors are going to be hard to reach after the mobo is interred, connect those cables first. Ensure the backplate is fitted flush in the case, and screw the motherboard in place. If you have a modular PSU, plug in the cables you need or discard the ones you don't. You'd run into space issues trying to fit a full-length graphics card and a modular PSU.



### 6 HARD DRIVIN'

Each hanging tray can hold two drives (2.5 or 3.5-inch). We only used two of the three trays (with our three hard drives and one SSD), which worked out pretty well, as it allows some extra breathing (or cable-stuffing) space. You'll need this space if you're fitting a long graphics card, too. It takes a bit of dexterity to fit a second 3.5-inch drive into each tray, but once you've got one screw in (use the large-headed ones for 3.5-inch drives), it's straightforward. Just be mindful not to bump drives into one another during installation. Once the trays are secured, put the lid back on the case, attach a monitor, cross your fingers, and power up your glorious NAS box. If it works, try to convince it to boot OpenMediaVault from a USB stick. The NAS should display its IP address once booted, at which point you can log in from your browser.





**1** The Hyper 212 is one of the best budget coolers there is, and we liked that it just fitted into our case and no more. Just being a NAS doesn't require much of the CPU, so it shouldn't generate much heat. We never saw temperatures exceed 50 C, which was achieved while streaming hi-res movies with the Plex plugin.

**2** Be Quiet! makes lovely PSUs, but 650W is far more than we needed – 400W would probably have been fine. The fan ends up exhausting a little close to the ground, so carpeted floors are no friend of this machine.

**3** Using old drives like this is a little risky, and consumer drives in general aren't meant for serious data storage. We just wanted the drives out of our main machine, and probably would survive if the data on them was lost. OMV can monitor SMART statistics, which can warn you about impending drive failure.

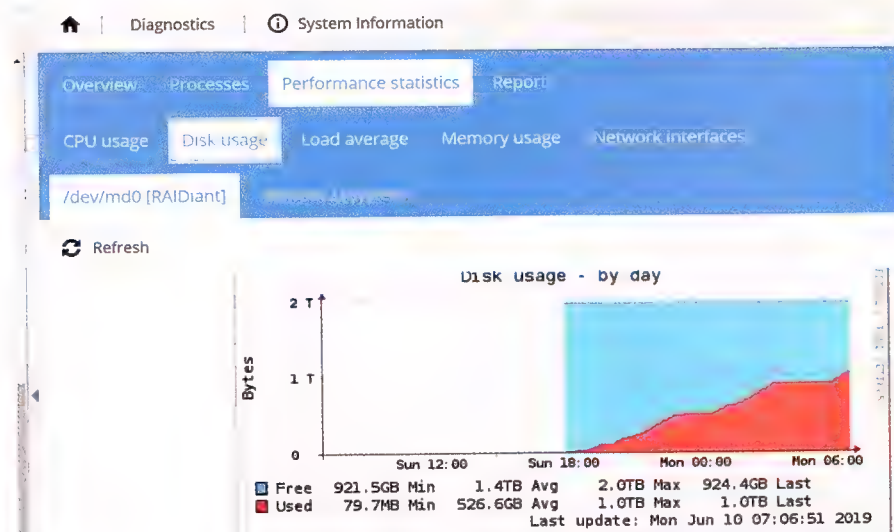
## Naughty but NAS

Well, that was fun. Except for the building part. Before you embark on such a project, consider this: Do you really need a case this small? Life is much easier when you have room to breathe. The final build was certainly messy, but perhaps with a differently arranged motherboard and PSU, it would be less of a plastic jungle. The fans in the Node 304 aren't the quietest creatures, but with them set on low, noise was tolerable, and idle temperatures stayed well below 40 C. Incidentally, if on first boot OMV tells you that it can't see the network (and the network cable is definitely plugged

in), it's possible that DHCP negotiations just took a little too long. You can log in locally with the username "admin" and password "openmediavault" then type "ip a" (everything without quotes here) to see the correct IP. From then on, you can do anything you want by visiting that IP address in a browser, and using the slick web interface. As is customary with all things Linux, reading the relevant documentation is a good idea, but your first port of call should be "Storage > Disks" to wipe the drives (this is especially important if they have been involved in a RAID array before), and then create your RAID array. You

have a few choices filesystem-wise – we went for traditional Ext4, but on a larger array, Btrfs might be a better idea. To be honest, we would wait for OMV 5.0 until you did that, because it will have much better support for the new filesystem's manifold bells and whistles (in particular, its built-in RAID pooling and magical self-healing abilities).

It was a shame not to be able to fit the case with its full complement of six drives. Indeed, it's possible to run the OS from a USB stick, so we could have had a four-drive array (RAID 6 or 10), with two "hot" spare drives. That was all moot thanks to our motherboard's weak offering of just four SATA ports. RAID 5 is probably fine for our purposes, but on larger (or older) drives, the relentless reading that a rebuild (if the array fails) necessitates will probably kill another drive as well as your redundancy. And by extension all your data. Oh yes – RAID is not backup, so back up your precious files. It left very little room behind the hard drives, and with the case full, there probably would have been airflow issues. Perhaps a modern CPU and smaller cooler (say a Ryzen 2200G with stock cooling) would be more suitable. It would also have been fun to use the experimental SnapRAID and MergerFS plugins. But in the end, we were impressed with OMV, and pleased to make use of old hardware. ■





# how to

» QUICK TIPS

## Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

### SECURITY & PRIVACY

#### CLEAN UP AFTER GOOGLE

*Like many others, I am unnerved by the amount of data that Google appears to hold on its users. How do I reclaim some kind of control over this? I don't want Google holding on to my data forever.*  
Stan Turner

If you want to give up Google, then you can start transitioning to other products and services using <https://nomoregoogle.com/> as a starting point. That's not necessarily practical, but thankfully you can control just how much data – and for how long – Google can hold about your online habits. Log into <https://myaccount.google.com/> and click Get Started under 'Review your privacy settings'. Click 'Manage web & app activity' followed by 'Choose to delete automatically' – select the

three-months option to minimise the amount of data Google keeps. Google also has a built-in Inactive Account Manager. Visit <https://myaccount.google.com/inactive> for details of configuring your account to automatically close in the event of your death or should you simply stop using Google. It can be configured to become inactive from anywhere between three and 18 months, and you'll receive plenty of warning up to a month beforehand, so you can reset the clock if necessary.

Ian Sleightholm

### STORAGE

#### DIAGNOSING FILEVAULT PROBLEMS

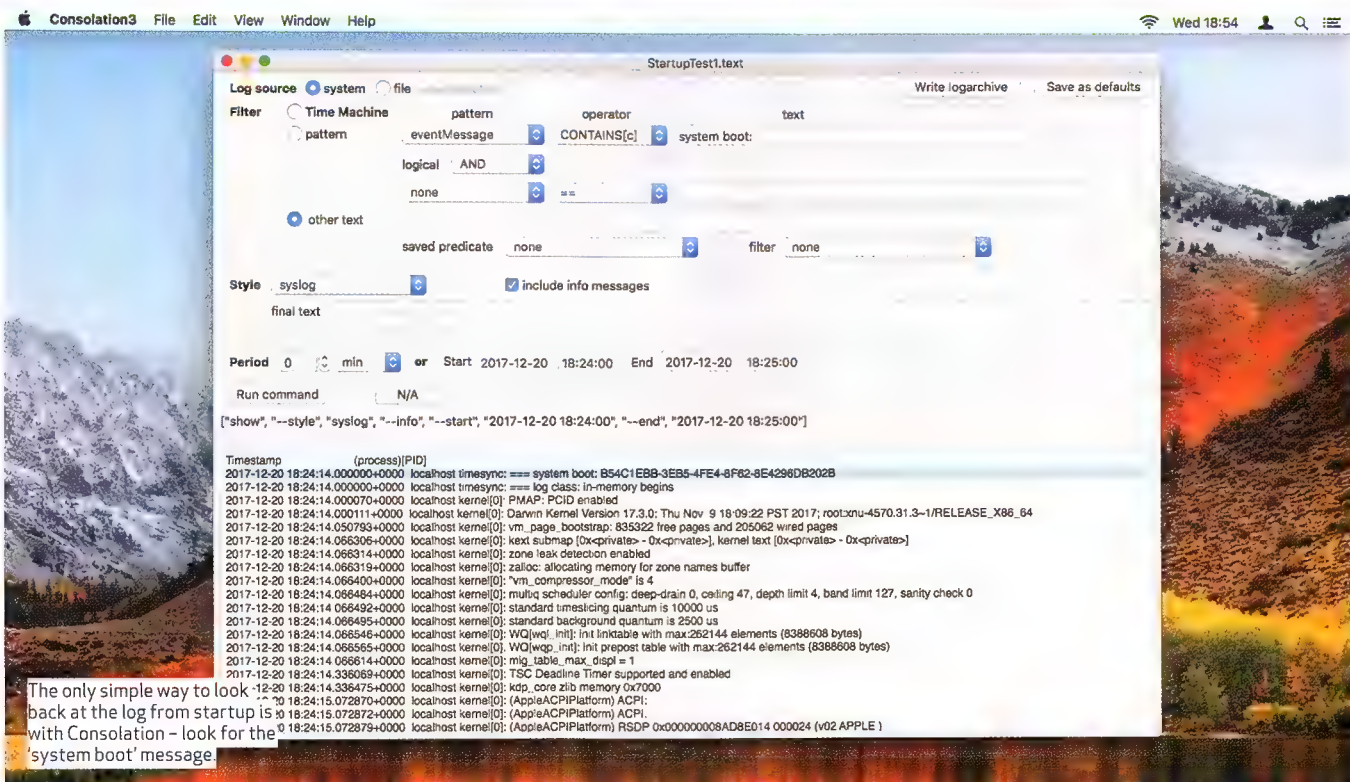
*My startup disk is encrypted using FileVault, which worked fine, but I'm now having problems getting into it when my Mac starts up. I fear that I'll need to decrypt it and start again. Is there any way to diagnose the problem from the Mac's log?*  
Paul Shalley

You might be lucky, but when using FileVault you may well be unable to read any log entries from before the

"I am unnerved by the amount of data that Google appears to hold on its users. How do I reclaim some kind of control over this?"

The screenshot shows a web browser window with the Google My Activity page. The page title is "Google My Activity". On the left, there is a sidebar with links: "Delete activity by", "Other Google activity", "Activity controls", "Google Account", "Help", and "Send Feedback". The main content area is titled "Web & App Activity" and features a search icon, a laptop icon, and a document icon. Below the title, there is a paragraph explaining that Web & App Activity includes things done on Google services, sites, apps, and devices. It also states that the activity is used for personalized experiences. Below this, there is a section with a toggle switch for "Web & App Activity is on", which is currently turned on. Below the toggle, there is a message: "Your activity is being kept until you delete it manually". Below this message, there is a link: "Choose to delete automatically". At the bottom of the page, there is a footer with links for "Privacy" and "Terms", and a statement: "Only you can see this data. Google protects your privacy and security. Learn more".





disk is unlocked. Normally, from Sierra onwards, the beginning of the startup process is marked by a log entry containing the message 'system boot:', while earlier systems use 'SYSTEM\_BOOT' instead. Locate the time of that, then view log entries from perhaps 10 seconds before that for the next minute, looking for those that appear relevant.

The problem is that before the startup disk is unlocked, your Mac can't write any entries to the log. What it may do is record these in memory, as it normally does when keeping the log, and once the disk is unlocked it may write those contents to its log files on disk. If that's the case, this is probably the only way to discover what's going wrong. Otherwise you'll almost certainly have to disable encryption and see whether the problem then goes away. Howard Oakley

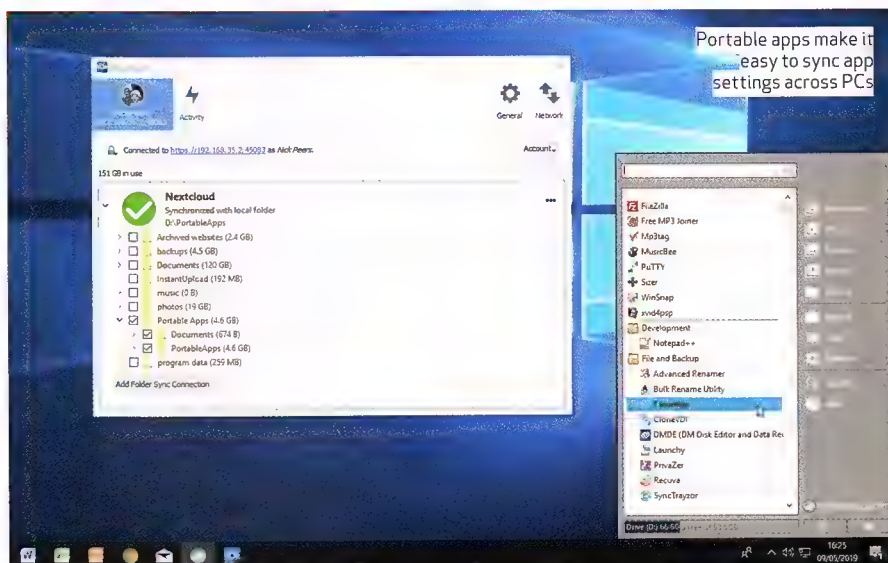
## APPLICATIONS

### KEEP PROGRAMS IN SYNC

*I have a desktop and a laptop, and I'm looking for the easiest way to keep my programs and settings in sync between them.*

Robert Ash

Thanks to the way programs are installed on your PC, it's virtually impossible for you to copy a program inside the Program Files folder to another computer. You'll also need to transfer files buried in other directories (such as the hidden AppData folders) as well as Registry



settings. One solution is to switch to portable apps – programs that keep their settings in a single folder. Visit [www.portableapps.com](http://www.portableapps.com) to start, and then check the website of your favourite programs to see if they offer portable builds. These can then be stored in a cloud-synced folder like OneDrive to keep things in sync between two or more PCs. If you're an advanced user, you might also want to look at CloneApp ([www.mirinssoft.com/ms-apps/cloneapp](http://www.mirinssoft.com/ms-apps/cloneapp)), not just for backing up files and settings, but also to identify where installed programs keep their settings. If any programs exclusively store program settings in files rather than in the Registry, you could make a note of the folders and

files in question, then use a file-sync tool such as Syncthing (<https://syncthing.net/>) to keep them in sync. Nick Odantzis

### IS THIS QUARANTINED DLL DANGEROUS?

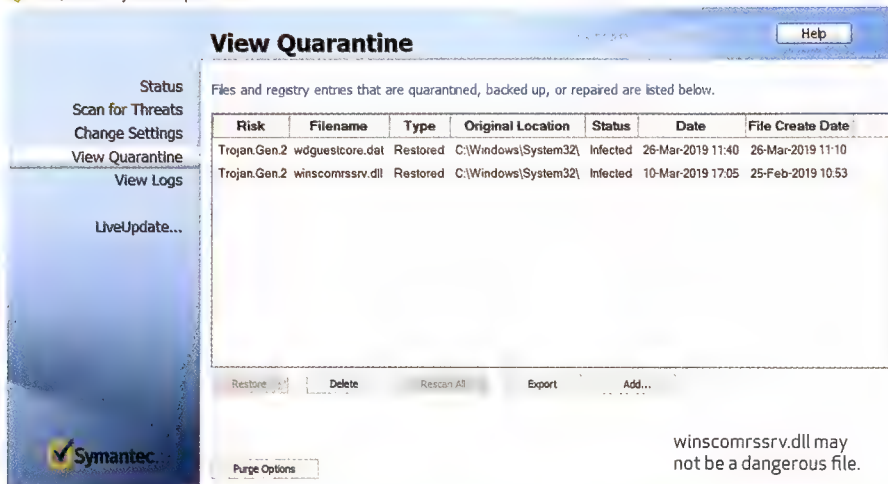
*I started receiving an error on startup telling me that RunDLL can't find a specific module: winscomrsrc.dll. The file was quarantined by Symantec Endpoint Protection, and other than this error message my PC appears to run fine. Can you assist?*

Zill Niazi

The file in question only started appearing in web searches from the end of March, and at first it appeared



View Quarantine - Symantec Endpoint Protection



transfers you to the captive portal: <http://neverssl.com> is a safe one to bookmark.  
Mayank Sharma

## MEDIA

### STITCHING AUDIOBOOK CD TRACKS TOGETHER

I read with interest your Q&A last month on ripping using iTunes. My CDs have up to 60 tracks per disc – great for CDs, not so good for streaming. What's the best way to stitch these together?  
Kathleen Tate

iTunes enables you to stitch multiple tracks together into a single file when you rip: select all the tracks you want to join together – say the contents of a single chapter split across multiple tracks, then click the Settings button and choose 'Join CD tracks'. Repeat for the next chapter on the disc, and so on and so forth. Once done, rip the CD as normal and you'll find the joined tracks have been combined into a single file. Some audiobook CDs split a single chapter over two discs, so what can you do?

The solution is to rip the first half of the chapter from disc one as a single file, then repeat for the second half of the chapter from disc two. You now have two separate files that need to be merged as one – assuming you've ripped them in the universal MP3 format, you can combine them into a single file with the help of Free MP3 Joiner (<http://convertaudiofree.com/free-mp3-joiner.html>). Launch the tool, then click Browse to select the two files you wish to join. Enter a suitable filename for the output file, and finally click Join. The process is virtually instantaneous because neither file is re-encoded, which also means the quality of the combined track is identical to the original files. Once done and tested (click 'Open Output folder...' to access the new file), you can delete the original audio files and update your library.  
Carrie Marshall

## WINDOWS

### RENAME FILES ACROSS MULTIPLE FOLDERS

I record various satellite audio streams. Is there a way to rename and move all the relevant files (000.ts) to a single directory so that I can edit them to listen to in my car?  
Yousuf Ebrahim

The tools you need can be found in the brilliant – if complicated – Bulk Rename Utility. Download and install it from [www.bulkrenameutility.co.uk](http://www.bulkrenameutility.co.uk) and then follow our step-by-step guide.

"These 'captive portals' work by hijacking any attempt to access the internet."



to be linked to a virus, with multiple security tools (including Endpoint Protection) flagging it as malware. After some digging, we linked the file to Dell software – Zill has an Alienware laptop – and in particular the A WSoundCenter program, which is linked to the laptop's sound chip. Further digging revealed that the sound driver had been updated on 20th March, which seemed too coincidental. Our guess is the file is a false-positive. If you encounter similar warnings it's best to run a quick search online and see if it's simply from a new update that hasn't yet been cleared by the AV app.  
Nick Peers

## INTERNET

### I CAN'T CONNECT TO PUBLIC WI-FI

Around six months ago, I discovered I can no longer connect to a wide range of public

Wi-Fi hotspots on my Surface Pro 3. I've tried everything I can think of, but with no luck. Any suggestions?  
Laurence Anderson

This problem is caused by the way that Wi-Fi hotspots perform to ensure that you actually log in before you can browse. These 'captive portals' work by hijacking any attempt to access the internet, redirecting it to the login page – this is something you typically also see in hotel rooms. Unfortunately, the behaviour is similar to so-called Man-in-the-Middle browser hijacks, and when you're being diverted from a secure (https://) web page, your browser and web server interpret it as such and block it.

Many people have reported success logging on by browsing to a non-secure website first, which then gracefully



Open Bulk Rename Utility. First, browse to the top-level folder containing all of the files that you wish to rename. Locate the Filters section (12) and type 000.ts into the Mask. Click the Refresh button next to it and then tick Subfolders.

We're going to rename each of these files ###-audio.ts, with ### being a unique number from 001 up. In the Replace (3) section, enter 000 into the Replace box and -audio into the Find box. Set Numbering (10) mode to Prefix, and Pad to 3.

Select all the files in the File pane and you'll see the New Name field update to preview what the file will be renamed. Next, click the folder button in the Copy/Move to Location (13) section to select a folder you'd like the files to be saved to.

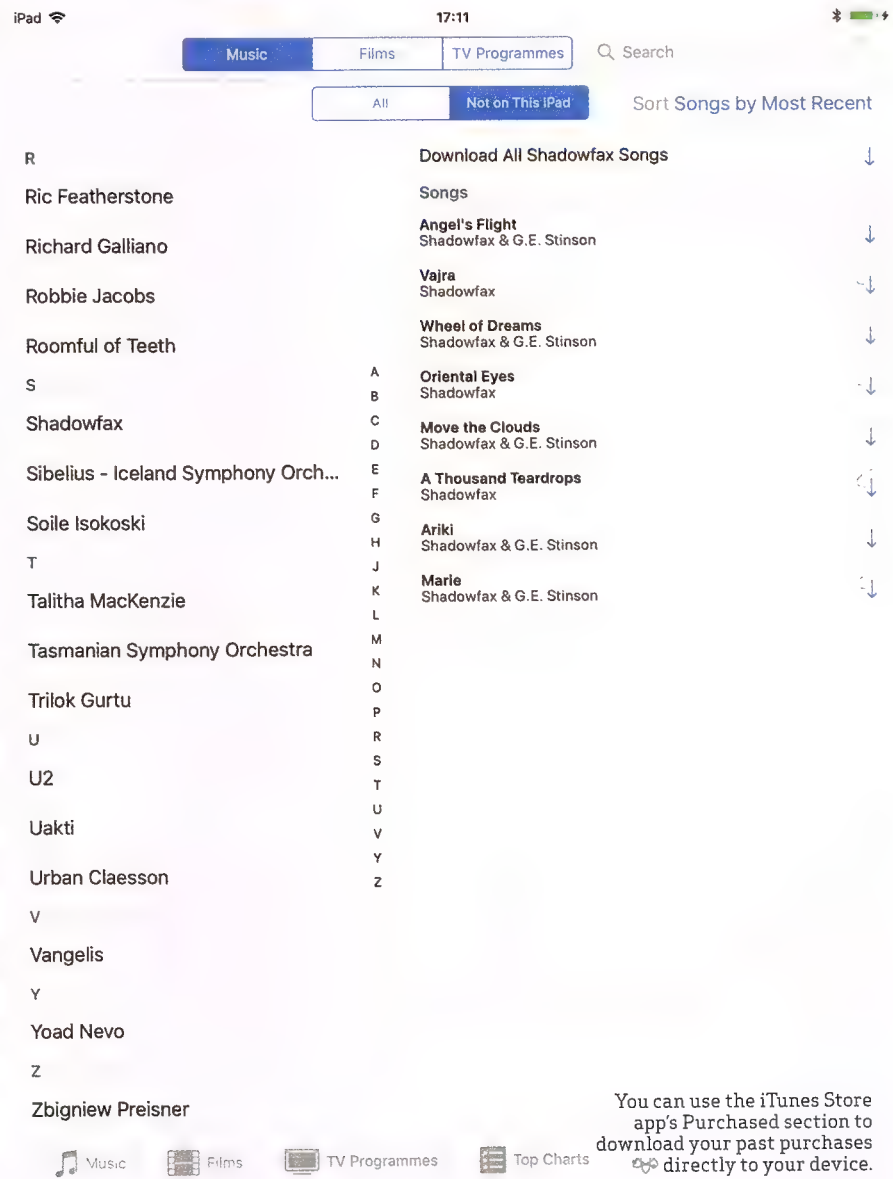
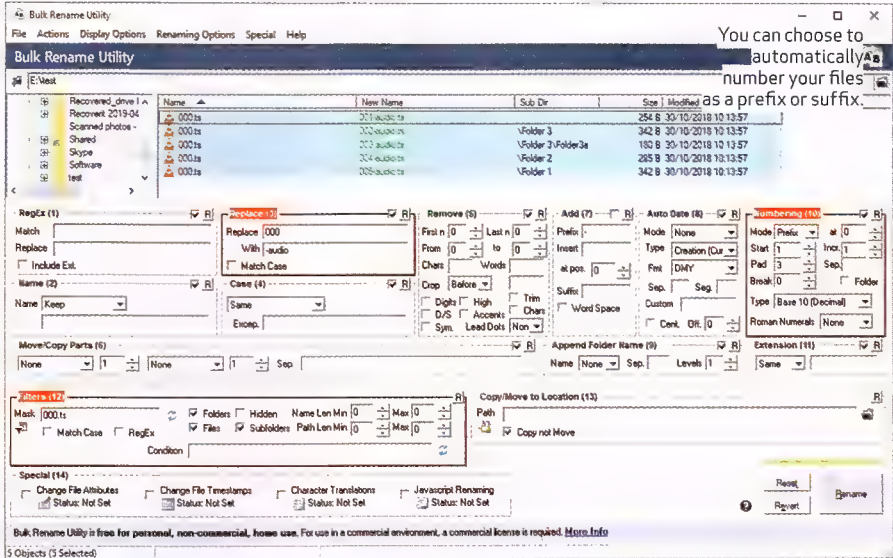
Review your settings – you can click and drag individual files in the File pane to rearrange them to change how they're renamed. Click the Rename button, review the warnings and – if you're still completely happy – click OK. Catherine Ellis

### IOS LOCAL ITUNES FILES

I have a Windows PC which holds my master iTunes library of about 1,000 purchased tracks. Whenever I sync those with my iPhone/iPad, many tracks and videos are shown with a cloud icon, and have to be downloaded again. How can keep them on my iPhone and iPad? Jane Berry

The iCloud Music Library switch in Settings > Music should only appear when you have an active subscription to Apple Music or iTunes Match. As your sub is no longer active, that would explain why it no longer appears for you. Tracks that you've bought from the iTunes Store will appear in the Music app, and we've encountered a situation where an iPhone lists two copies of such tracks: one synced from our Mac and a version in the cloud. Other people have reported your situation, too.

Forcing iOS to download all tracks and films is tedious – and you shouldn't have to do it on top of syncing with a Mac. However, if you find it necessary, it can be done in batches rather than tapping the download badges next to every track. Open the iTunes Store app, then tap Purchased at the bottom (on an iPhone, tap More first to find that option). Select Music, Films, or TV Programmes as appropriate, and at the top select 'Not on this [device]'. Tap an artist's name, then Download All at the top of the list of their tracks. Repeat for all other content you want to store on your device. You'll probably also want to turn off



using mobile data to download tracks, to see whether that discourages iOS from making your tracks only available from the cloud. Do that in

You can use the iTunes Store app's Purchased section to download your past purchases directly to your device. Settings > Music > Mobile Data. Unless you have a generous data allowance, that's probably a wise move anyway. Howard Oakley



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# Start using Google Drive

Mark Wycislik-Wilson shows how storing files online is a great way to make them accessible from Google Drive.

**T**alk of 'the cloud' can be confusing if you're unfamiliar with the term, but it is really just a way of referring to storing files online. You may want to store a second copy of important files online to serve as a backup, or you may want to access your files from any computer connected to the

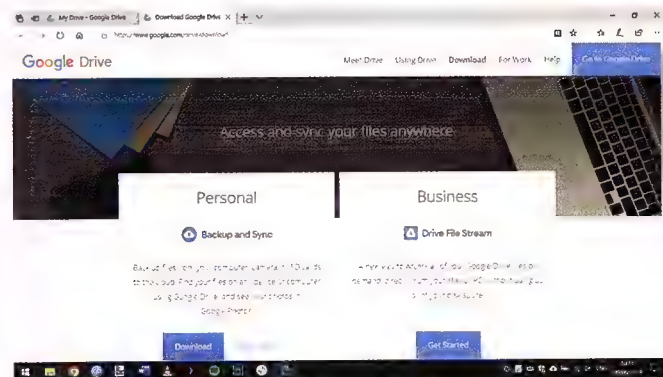
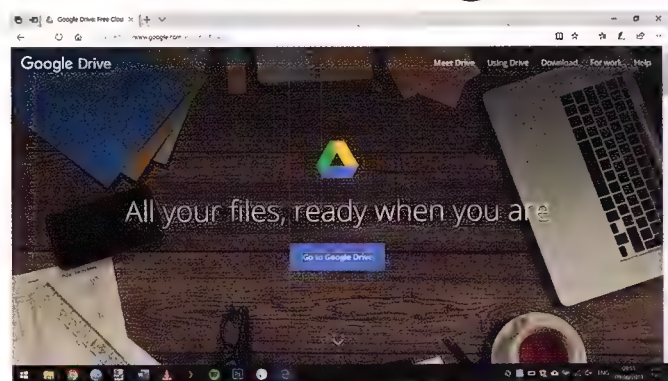
internet. Storing files in the cloud also makes it easier to share them.

There are numerous cloud storage services to choose from, but perhaps the most well-known is Google Drive. You can use it in a couple of ways, the first being using your web browser to browse, create and edit files online. Perhaps more useful is to download the

desktop software – called 'Backup and Sync' – as this enables you to select a folder on your computer's hard drive that will be synchronised to Google Drive online, and you can sync with multiple computers so the same files are available everywhere.

Here's how to get started.

## Your first Google Drive encounter

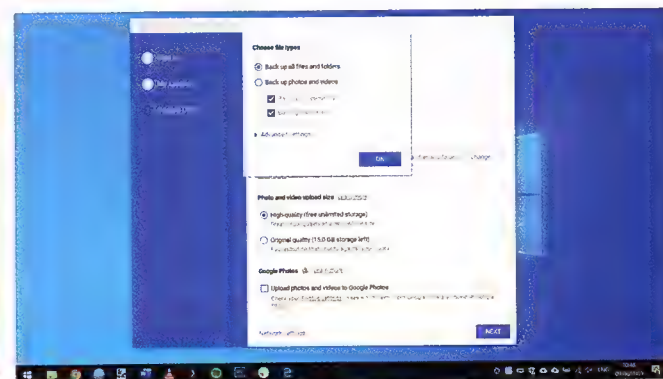
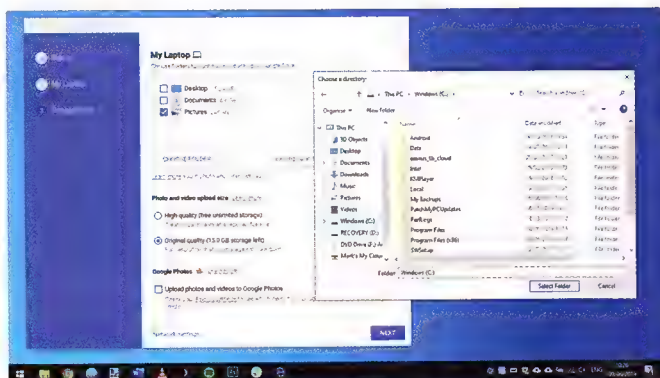


### 1 SIGN UP FOR AN ACCOUNT

Pay a visit to the Google Drive website at <https://drive.google.com> and click the Go to Google Drive button. If you already have a Google account, you can sign into it and start using Google Drive, but if not you can click the 'Create account' link to get started. You'll be guided through the process of choosing a Gmail email address and securing it with a password.

### 2 DOWNLOAD BACKUP AND SYNC

When you are signed into Google Drive, look to the lower left of the page and click the button labelled Get Backup and Sync for Windows. You will be taken to the download page, and you need to click the Download button in the Personal section. Save the file, and then run through the installation. Launch the program and you will be invited to sign into your Google account.



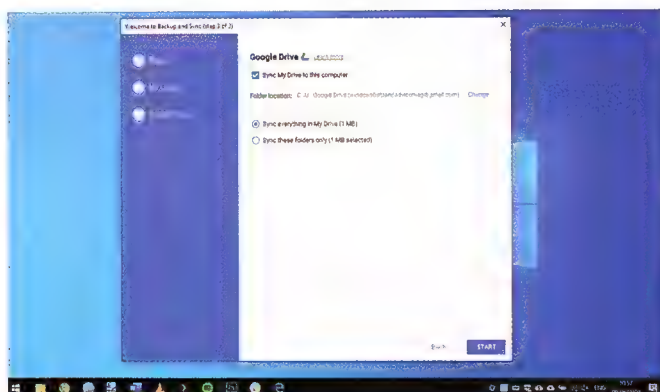
### 3 CONFIGURING BACKUP AND SYNC

Choose which folders you would like to synchronise between your computer and Google Drive. Backup and Sync automatically selects your Desktop, Documents and Pictures folders, but you can deselect these. You can also add more folders with the Choose Folder button. There's no limit to the number of folders you can sync, other than the amount of space available.

### 4 FILE AND PHOTO OPTIONS

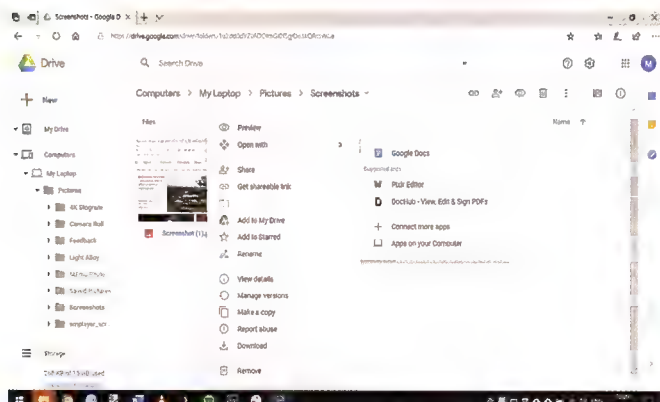
By default, all files in your selected folders will be backed up, but you can adjust this with the Change button. You can opt to only back up the image files in those folders, or click Advanced Settings to specify file types to ignore. To avoid filling all your storage with photos and videos, you can opt to drop their quality to High and you will be given free, unlimited storage for them.





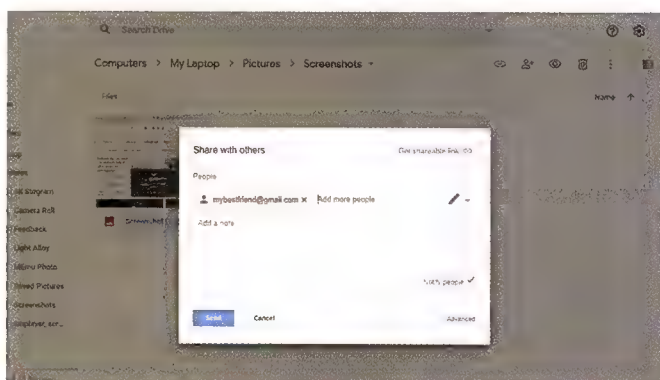
## 5 YOUR GOOGLE DRIVE FOLDER

Click Next, and you will be prompted to choose a folder on your hard drive where Google Drive files should be stored. Any files and folders you add to this folder will be automatically sent to Google Drive online, and any files you create online – or that are synchronised from other computers or devices such as phones and tablets – will be synchronised to this folder.



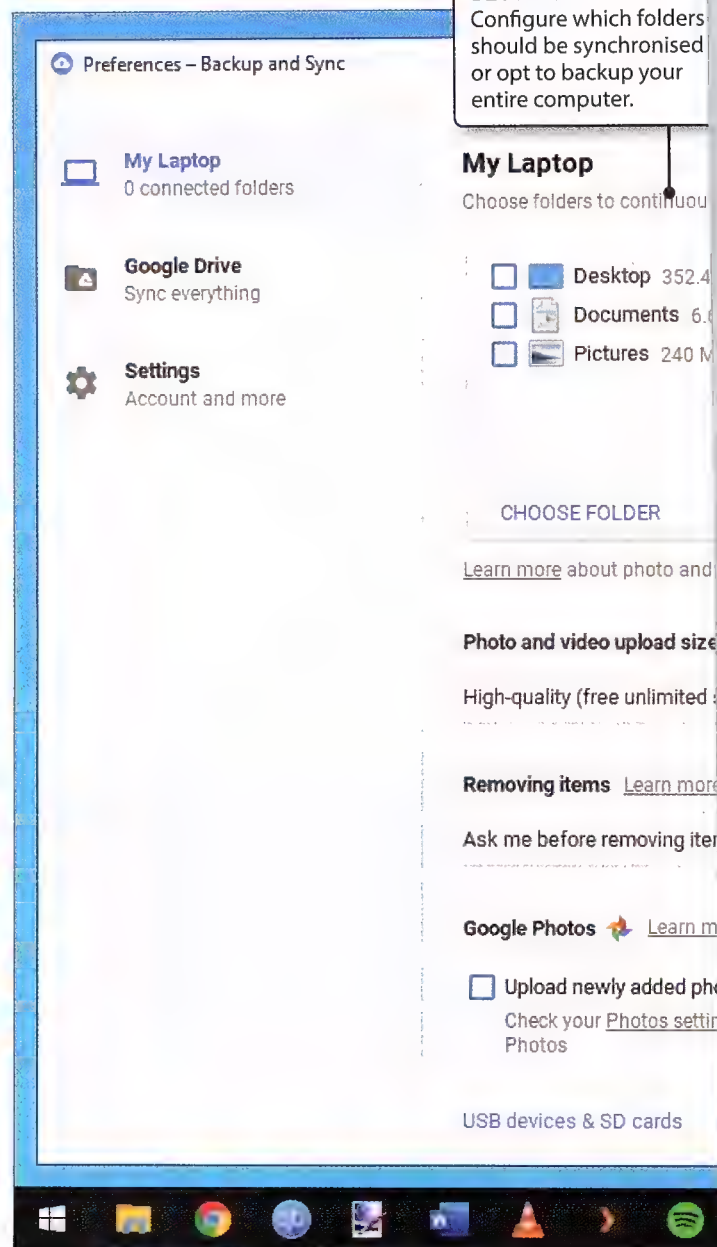
## 6 NAVIGATING FILES ONLINE

You can continue to create and edit files on your computer as normal, and any you place in the Google Drive folder will be synchronise to the cloud. Many types of files can be viewed or even edited online. Visit Google Drive in a web browser, and you can navigate through your files. Double click a file to open it, or right click to choose an online app that can be used to edit it.

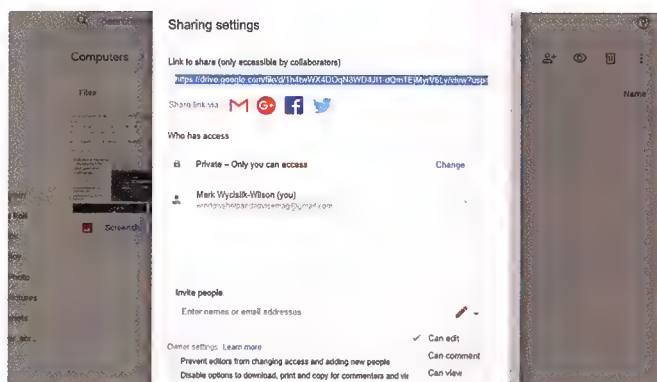


## 7 SHARING FILES WITH OTHERS

One of the great things about Google Drive is that it enables you to easily share files with friends and family. On the Google Drive website, or on your computer, you can right click a file or folder and select the Share option (in the Google Drive sub-menu on your computer) before entering someone's email address. You can also add a note to be included in an email that is sent out.



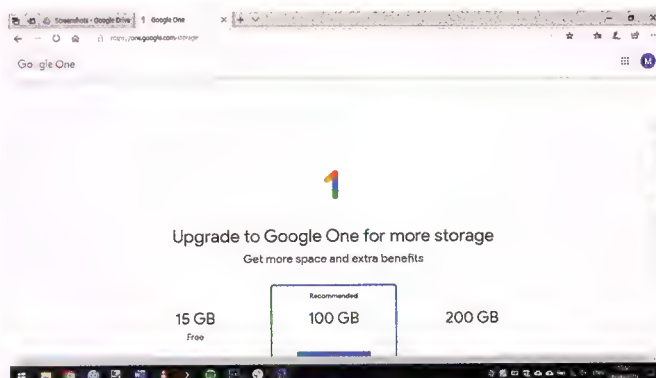
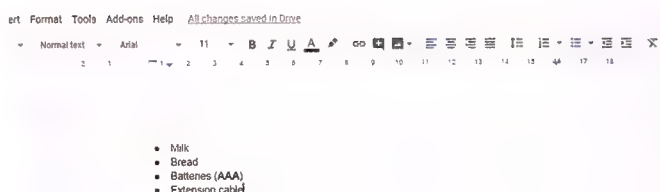
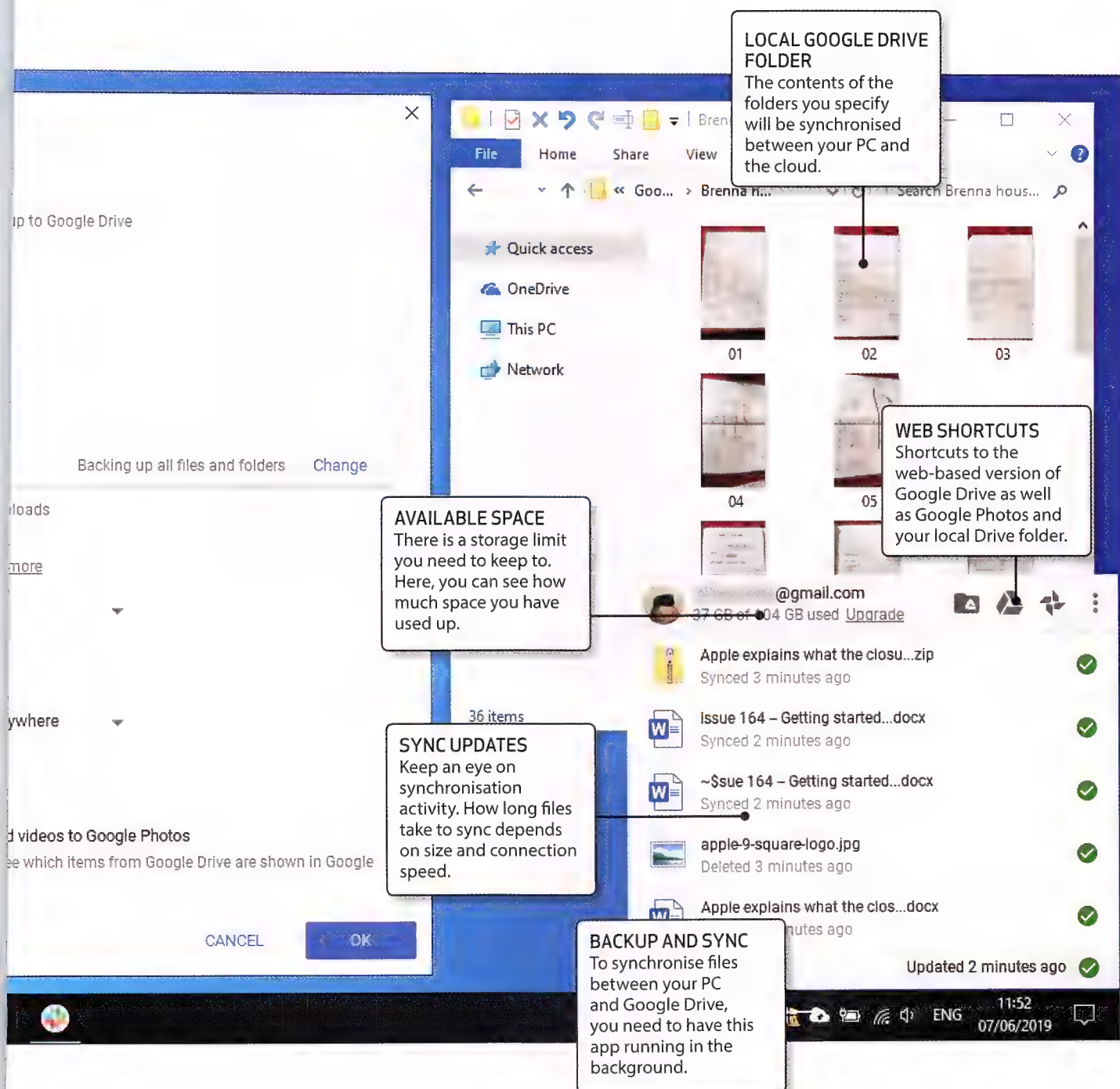
**BACKUP AND SYNC SETTINGS**  
Configure which folders should be synchronised or opt to backup your entire computer.



## 8 ADVANCED SHARING OPTIONS

By default, people you share files with will be able to edit them, but this can be changed. Having selected the Share option, enter someone's email address and click the button to the right before deciding whether they should be able to view, edit or comment on the file. You can also click the Advanced link to see other options, such as making files publicly available.





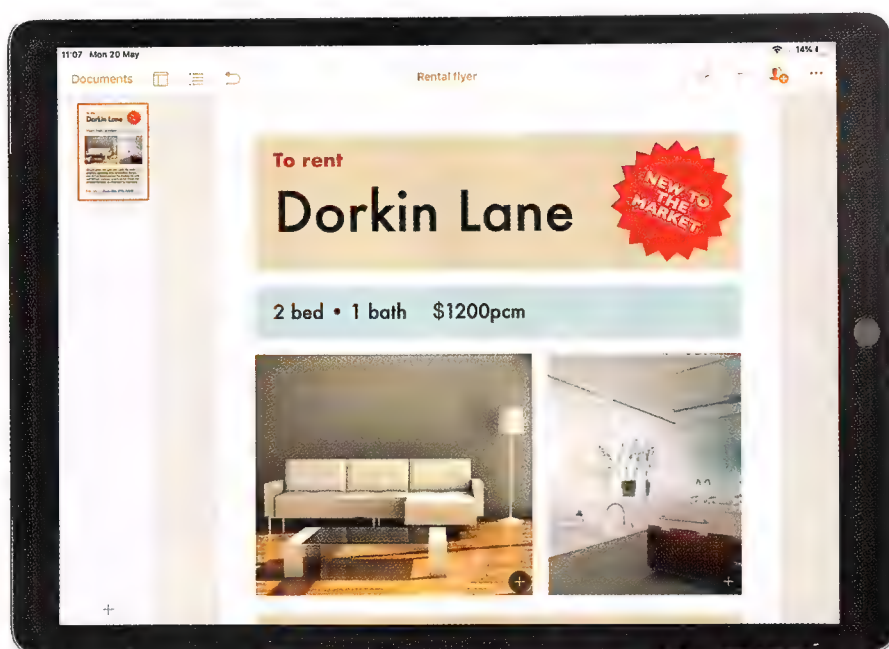
## 9 EDITING FILES ONLINE

Google has a number of online tools to create and edit files – including a word processor and a spreadsheet. Thanks to these, you can edit files online without the need to download them and load them into specific programs. Despite being online apps, they are surprisingly feature-packed, and you should find that you are able to accomplish pretty much everything you would expect.

## 10 GETTING MORE STORAGE

You are given free 15 GB of space with Google Drive, but the time may come when you need more – and you will need to pay for this. You can upgrade your storage by clicking the Upgrade link in Backup and Sync, or in Google Drive online. You can then choose the amount of storage you want, and choose between paying on a monthly or annual basis. ■





# Templates in Pages

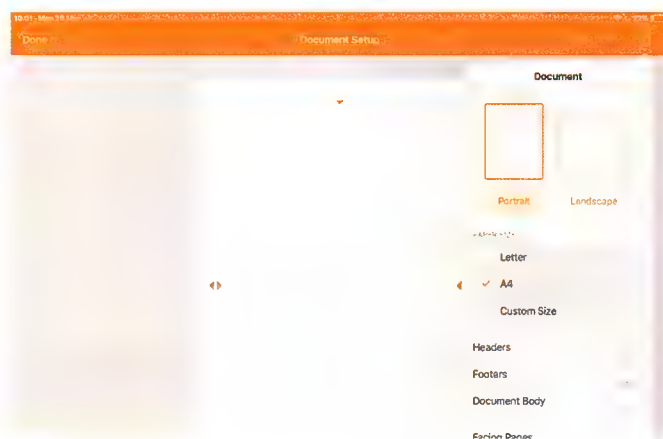
Adam Banks shares how you can now make your own templates for Pages documents.

**T**he updates to Pages, Numbers and Keynote for iOS that were announced at the end of March added the ability to save templates, plus more related features. You still can't create the text placeholders that you find in Apple's own templates – which can be tapped once to type over – but you

can now set images as placeholders. You can already tap any image, tap the brush icon in the toolbar at the top right, go to the Image tab and tap Replace to place a new image file within the same box. When you set an image as a Placeholder, it just means it gets a little + icon in the bottom right corner that does the same, but faster.

You can now switch Pages word processor documents to page layout mode (and vice versa), rather than the mode being fixed by the template you chose when creating a document. Finally, any objects that you create can be saved, and will sync via iCloud, so you can use them again. Just tap and pick 'Add to Shapes' to do so.

## How to Create and save a template

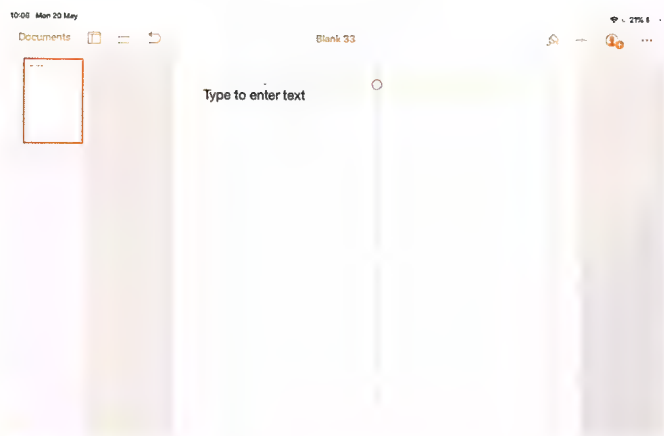


**1 MAKE A BLANK DOCUMENT**  
In Pages' template chooser, tap Create Document and choose Blank. Tap More (...) > Document Setup > Document Setup icon (top right). To use page layout mode, turn off Document Body. Turn off Header and Footer.



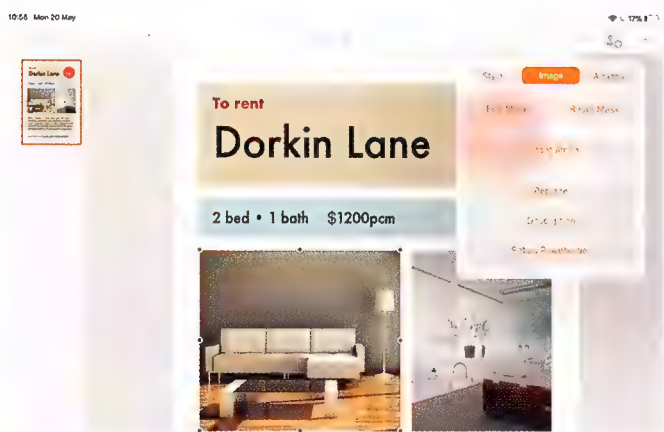
**2 SET YOUR MARGINS**  
Setting page margins here should help make a neat layout. Oddly, in page layout mode, Pages ignores them. We'll work around that. Tap the + icon, pick a square from the shapes tab and resize it to fit the margins.





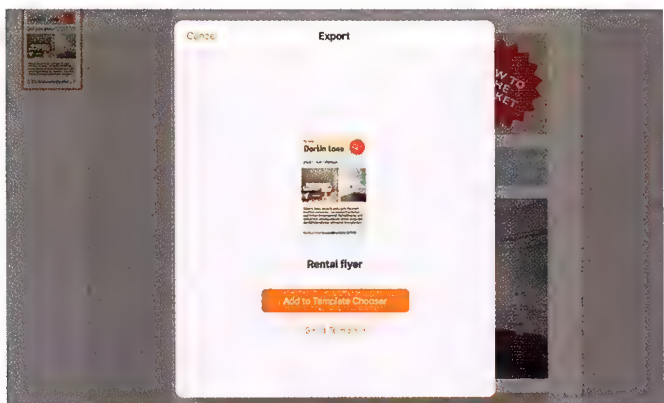
### 3 POSITION A TEXT BOX

It snaps to the margins (if not, turn on all in More > Guides). Tap the brush icon and, on the Style tab, set no fill or border. Click Done. On your page, try adding a text box. You can now snap it to the margins.



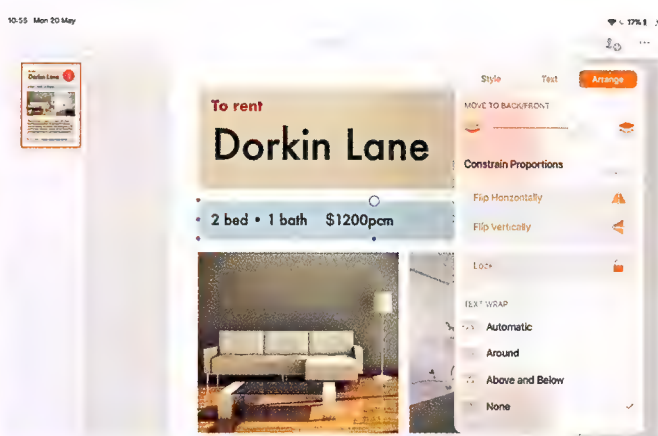
### 5 SET IMAGE PLACEHOLDERS

To make an image a placeholder, tap it, tap the brush icon, and choose Set as Placeholder from the Image tab. A + sign appears at the bottom right of the image, and can be tapped later to quickly replace it.



### 7 SAVE AS A TEMPLATE

You can add more master pages to your template. Click Done. Name your template at the top, then from the More menu, pick Export > Pages Template to add your design to Pages' template chooser or save it.



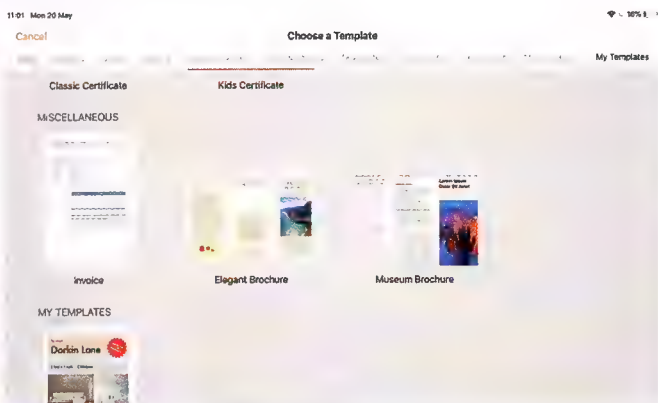
### 4 LAY OUT YOUR TEMPLATE

Using Pages' helpful auto-guides and your invisible margins, complete your layout with example text and pictures. To prevent an item being moved accidentally later on, tap it, tap the brush icon and choose Arrange > Lock.



### 6 CONVERT TO MASTER

For better templates, use master pages. Tap on an edge of your page and pick Select All, then tap and pick Cut. Tap the page thumbnail in the left sidebar and pick Edit Master Page. Tap on the page and pick Paste.



### 8 USE YOUR TEMPLATE

When you create a document from your template, the template stays intact while a new document identical to it appears, ready to edit. Tap the + sign on an image to replace it with a file or take a photo. Double-tap text to edit it. ■





# Manage iCloud Drive

Make the most of Apple's convenient online storage facility. Kenny Hemphill shows you how.

iCloud Drive is the file storage part of Apple's iCloud services. It's a super-easy and convenient way to access your files from any of your devices, and operates very similarly to Dropbox, Google Drive, and Microsoft OneDrive, if you've used those.

It shows up as a folder in Finder and

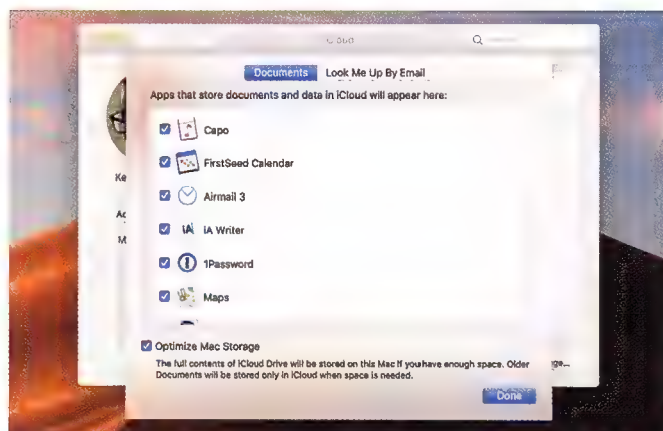
you can drag files and folders to and from it like any other. By default, a copy of everything in your iCloud Drive is stored locally on your Mac. Files you place in iCloud Drive are synced to Apple's server and made available on all the Mac and iOS devices signed in to your iCloud account. (Make sure yours are signed in: go to **System**

Preferences > iCloud on a Mac, and Settings > [your name] > iCloud on iOS.)

Files stored in iCloud Drive are encrypted, both in transit and on the server, as long as you have two-factor authentication enabled for your Apple ID. Confirm this by signing in at **appleid.apple.com** and checking that this has been switched on under the Security heading.

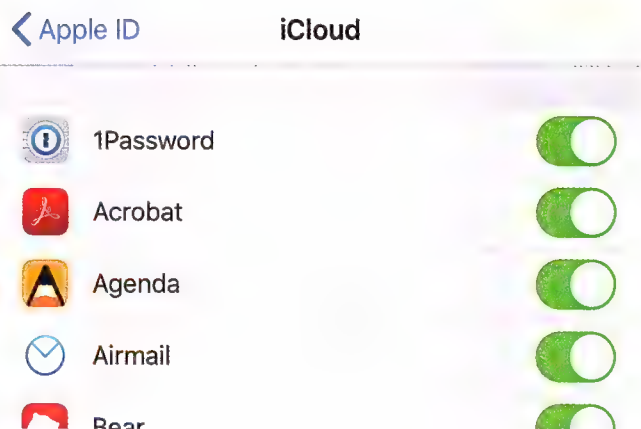
## How to

Manage iCloud Drive.



### 1 CONFIGURE YOUR MAC APPS

In **System Preferences** > **iCloud**, click **Options...** next to **iCloud Drive** in the list on the right. You'll see a list of apps that store files and other data in iCloud Drive. Clear the box next to apps you don't want data stored for.



### 2 CONFIGURE YOUR IOS APPS

On iOS, go to **Settings** > [your name] > **iCloud**. Scroll down to the list of installed apps; toggle off any apps you don't want data stored for in iCloud Drive. Note though that this might hinder some apps' functionality.







# Tagging files made easy

Shashank Sharma is a master of many things, self-aggrandising above all. Most of this power comes from using smart tools such as TMSU...

**L**inux users have a really easy way to achieve nirvana: finding a distribution that best fits all their needs. It only takes time, a lot of effort, and perhaps compromising on what you might consider an ideal fit, or maybe even your definition of nirvana. But it's doable, no doubt.

The obvious upside to finding a distribution that fits your needs is that you no longer have to hop distributions. Even better, if you decide on a rolling-release distribution, your next reinstallation will be a long time coming. The downside to having such a fixed abode is that the number of files on your system will grow exponentially. Unless you're a master at organising and take pains to carefully name and sort all your files, you're unlikely to be able to locate a file without spending considerable time searching for it. This is where a file-tagger such as TMSU comes in.

While the project name seems like a random selection of letters put together to arrive at a unique name, we're shocked to report that it's actually an abbreviation for 'Tag My S\*\*t Up'. Despite its usefulness, the project isn't available in the software repositories of any of the popular desktop distributions. The only exception is Arch Linux, which offers it as part of its Arch User Repository (AUR), and which was used as the base for this project.

## GET GOING

Written in Go, the minimalist project has only a few dependencies, and if you've been running your Linux distribution for some time, chances are that you might already have at least one or two if not all of the dependencies installed. If not, you can get them easily enough from the software repositories of your distribution, or install them using Go:

```
$ go get -u golang.org/x/crypto/blake2b
$ go get -u github.com/matttn/go-sqlite3
$ go get -u github.com/hanwen/go-fuse/fuse
```

Blake2b is a hashing algorithm, not unlike MD5 or SHA256. The

project in fact supports several of these, and uses them to create a fingerprint of your files. SQLite is the lightweight database which is used to maintain a list of all the tags you add to your collection of files.

When you tag a file for the first time, TMSU creates a fingerprint of the file and stores this in the database. This fingerprint is unique to each file, and can even be used to identify duplicate files.

With the dependencies in place, you can download the compressed tarball from the project's GitHub page (<https://github.com/oniony/TMSU>) or clone the GIT repository with `git clone https://github.com/oniony/TMSU.git`. Next, navigate into the TMSU directory and tweak the Makefile if you wish to change any of the default settings. However, the default configuration should suffice for most people.

You can now install TMSU by running the `make` and `sudo make install` commands. This copies the TMSU binary into the `/usr/bin` directory and also creates man pages, and even configures support for tab completion of TMSU commands in Zsh. Unfortunately, the project doesn't yet support tab completion for its sub-commands in other shells such as Bash, although the GitHub page features a user-contributed script which offers this functionality.

With the installation out of the way, the first step is to initialise the database for use with TMSU. You can do so by running `tmsu init`. The SQLite database is relative to your current working directory, and encompasses all sub-directories. This means that you can have separate TMSU databases for the `~/Documents`, `~/Music` and `~/Downloads` directories. Running the `tmsu init` command

"You're unlikely to be able to locate a file without spending considerable time searching for it. This is where a file-tagger such as TMSU comes in."

## Help and support

You can find a number of tips and tricks, a to-do list for future releases, a detailed explanation of unique concepts such as fingerprinting, database repairing, virtual filesystem and on at the project's wiki, hosted on its GitHub page <https://github.com/oniony/TMSU>.

For offline use, you will find sufficient instructions on the man page, coupled with some examples. Even better, you can invoke the `tmsu help <command>` command to access instructions for a specific command. The command `tmsu help dupes`, for instance, gives you all the pertinent information you would need to use the fingerprinting feature to identify all the duplicate files in the current database.

Wherever possible, the project provides helpful examples to enable users to make sense of the command options and what they do:

```
tmsu help merge
tmsu merge TAG... DEST
Merges TAGs into tag DEST resulting in a single tag of
name DEST.
```

Examples:

```
$ tmsu merge cehese cheese
$ tmsu merge outdoors outdoor outside
```

Options:

```
--value merge values
```



Whenever you now use TMSU, it will automatically look for a database at `.tmsu/db` within the current directory. If it doesn't find one, TMSU will keep looking for one in each parent directory. You can run the `tmsu info` command to determine the database currently in use. If you have several different databases, the output of the command will vary, depending on your current working directory.

## PLAYING TAG

If you've already created a database, you can start tagging files using the `tmsu tag <filename> <tag>` command. The command expects a filename and a space-separated list of tags you wish to assign to the specified file:

tmsu tag LXF-252-mcfly.odt  
LXF articles

```
tmsu: new tag 'LXF'
tmsu: new tag 'articles'
```

TMSU will inform you every time you create a new tag, but the `tmsu tag` command does not produce any output if the tag you wish to assign to a file already exists. You can similarly use the `tmsu tag --tags` command if you wish to assign the same tag to many different files:

```
$ tmsu tag --tags="LXF
articles" LXF-*
```

```

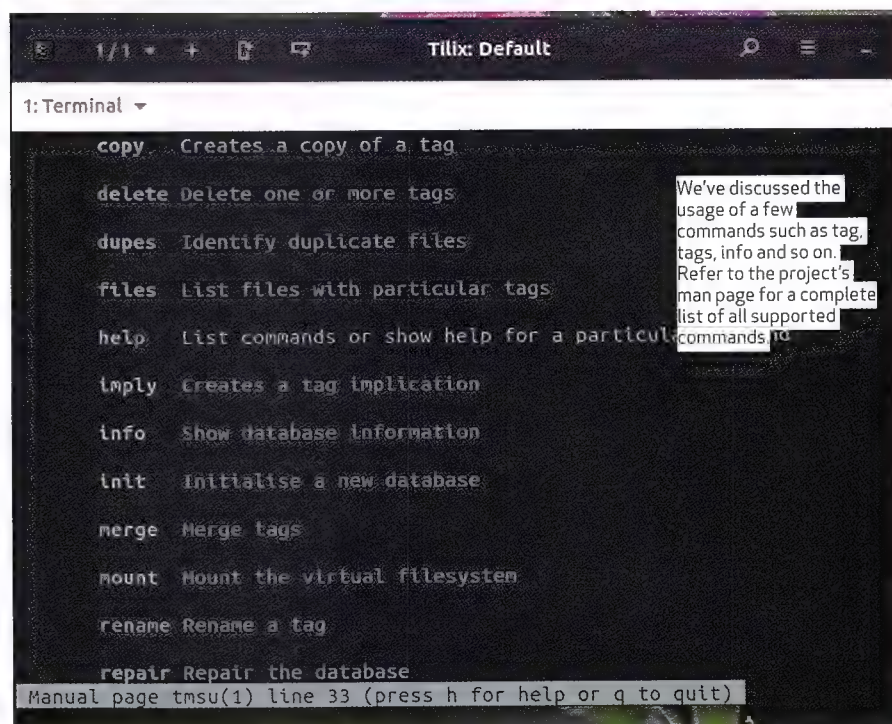
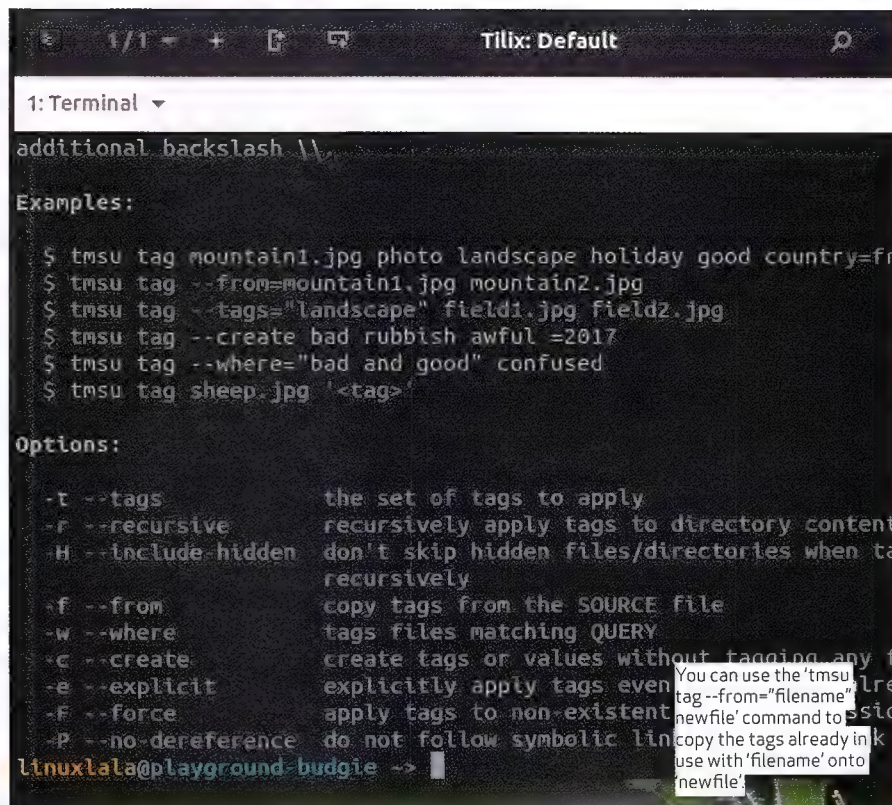
$ tmsu tag 00-LXF-
articles-to-do-list todo

```

```
tmsu: new tag 'todo'
```

You can even assign values to certain tags, to help make sense of files. For instance, the `year` tag can be used to sort files. The command `tmsu tag filename project year=2019` assigns the tags `project` and `year` to the filename, and adds value `2019` to the `year` tag. You can similarly assign different value to the `year` tag for different files. Even better, the `project` doesn't insist on numerical values being assigned to tags – so you can have a tag called `project` and its different values could be `now`, `later`, `over`.

While we've only discussed tagging files with TMSU, it is possible to also tag directories. When tagging a directory with the `tmsu tag <dir-name> <tags>` command, only the directory is tagged in the database and not its contents. You must use the `tmsu tag --recursive <dir name> <tags>` command if you wish to recursively tag a directory and its contents. The downside to tagging the contents of a directory is that



the operation takes longer to complete, and also results in a comparatively larger database.

As with most command-line tools, TMSU is case-sensitive. This means that `LXF` and `lxf` are treated as distinct tags. You can run the `tmsu tags` command for a list of all the tags currently in use:

```

$ tmsu tags

```

LXF articles lxf project todo year  
As you can see, the `tmsu tags`  
`command` produces a rather vanilla

output, and doesn't differentiate between regular tags and ones with a value assigned to them. For a list of all the files assigned to a specific tag, you must run the `tmsu files <tag>` command.

The fingerprint for a tagged file changes with each modification to the file. TMSU supports updating the database with a new fingerprint for a file, or changing the path of the file, if it's moved. 🟩



Samsung's new Galaxy A30 is one of many with USB-OTG support.



# Android OTG 101

It's the USB standard that makes Android devices much more fun, but it has some tricks and traps of its own. Darren Yates shows how to rock your phone with USB-On The Go.

**M**ost Android devices only come with a single connection port that has to do everything from charging the internal battery to connecting to your PC. But if that port is a USB On The Go port, it can open up a world of peripheral devices, everything from storage to microscopes. However, USB-OTG has a few tricks of its own that not only can make it confusing to use, there's no guarantee your Android device will even support it. This month, we're doing a deep-dive into the murky depths of USB-OTG with a primer to help you understand how to use it, what it can do, what it can't and how to find out if your device actually supports it.

## WHAT IS IT OTG EXACTLY?

No doubt you're used to USB ports on your PC or laptop – standard Type-A ports are the four-pin flat-ish connector that originate or 'host' peripheral devices. On the other end of your USB cables, you'll find a mix of

standard Type-B, miniUSB, microUSB and USB-C connectors that plug into your peripherals. Android devices feature either a microUSB or, if you have a more recent phone, a USB-C port. Through these ports, you connect up a power source to charge the device's internal battery, or you connect it up to your PC to download your media files to your phone or tablet's internal storage. USB-OTG is a separate set of USB standards that enables the device port to work bi-directionally – in standard mode, it acts as a typical device port, but it can also switch over to act like a standard PC 'host' port – to which, you can hook up peripheral devices.

## HOW OTG WORKS

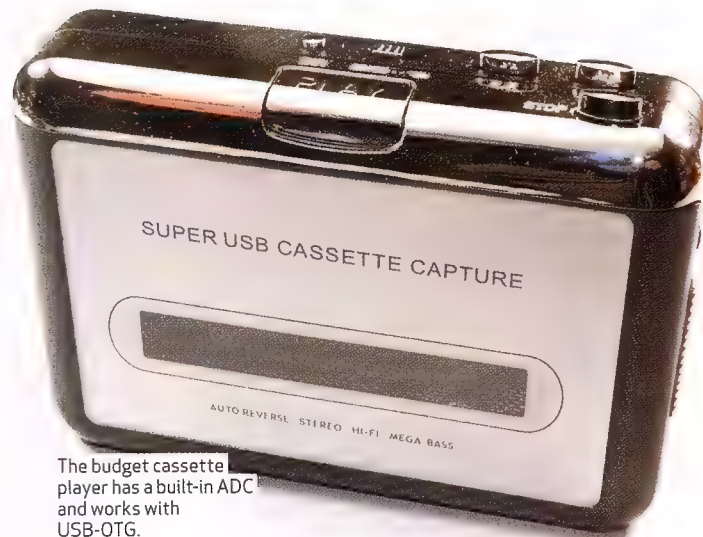
There are three things your Android device needs in order to have an active OTG port. First, you need the internal hardware support. Because OTG mode requires the port to switch modes, the USB hardware has to support OTG. If it doesn't, that's it – game over. The second component is the operating

system-level driver software – I've seen phones that have the OTG-ready hardware, but a lack of driver software meant the feature wasn't available, so your device must have supporting software. Third, you need a special OTG-to-host USB adapter cable (often just called an 'OTG cable'). These are often short (under 20cm) and usually sell for \$2 on Ebay. The cable does the switching inside the phone's USB connector to engage OTG mode. Again, you can't just use the cable that came with your device – it must be an OTG adapter, either a cable or converter device.

However, the problem with OTG as far as Android is concerned is that it's not actually a requirement of an Android device to support it, so there's no guarantee your device will. Now that said, it's typically only budget Android phones (often under \$70) that don't include OTG support. Almost all Android tablets support OTG – even the \$99 Lenovo Tab 7 Essentials model I bought last year. However, few devices advertise it, so you can rarely tell by



EasyCAP USB video capture dongles can work on Android via OTG.



The budget cassette player has a built-in ADC and works with USB-OTG.

reading the specs and definitely not by looking at it.

### CHECK YOUR DEVICE

But there are two ways to check whether or not your device supports OTG – you can simply plug in your bus-powered peripheral device via an OTG adapter and see if it powers up, or you can download a USB-OTG Checker app from Google Play. There are a number of these around – the better versions check for hardware and software driver support. Many of them are free, so don't spend cash on one. We've used the one by FaitAuJapon.com on Google Play.

The other key factor is your device's version of Android – thankfully, this is easily accomplished, as Google began supporting OTG or 'USB Host' mode in Android way back with Android 3.1 (although few devices had the hardware support until Android 4.0 arrived). However, there is one key issue where things do get tricky.

### POWER CONSIDERATIONS

The issue that's often forgotten with OTG is power. Standard PC USB 'host' ports are designed to work with peripheral devices that supply their own power, such as a USB printer, but also with bus-powered devices, like USB flash drives. For these bus-powered devices, the PC host and peripheral device communicate and 'hand-shake' an agreement between them on how much electrical power is needed and how much can be supplied. USB-OTG has to do the same thing, but this creates three issues with Android devices. First up, it's never written just how much power a peripheral device can pull from a phone's OTG port. PC ports can be designed to deliver up to 1800mA of current – try to pull that much out of your phone and it'll beg for mercy under the load. In practice, if the OTG hardware doesn't fail, the 5VDC voltage it is supposed to produce for the OTG peripheral device will droop under the load until it's too low for that device to operate. The device switches

off, the volts then come back up, the device powers on again, the volts drop and around the 'loop of death' it goes.

The second problem is related – if you're connecting a bus-powered device, the power required to run the device is coming from your Android phone or tablet's battery, so battery life will take a proportional hit. This also relates to the third problem – and the one least understood – and that is you cannot charge your Android device while ever it is in OTG mode. Putting it in simple terms, once OTG mode is engaged, the power direction is always away from your phone/tablet and towards the peripheral device. Early Android tablet got around this problem by simply including a separate DC power socket. Android phones have never had that luxury, so it essentially means that while you engage OTG mode – even if the peripheral device is self-powered (has its own power supply) – you cannot charge your device's battery via the USB port.

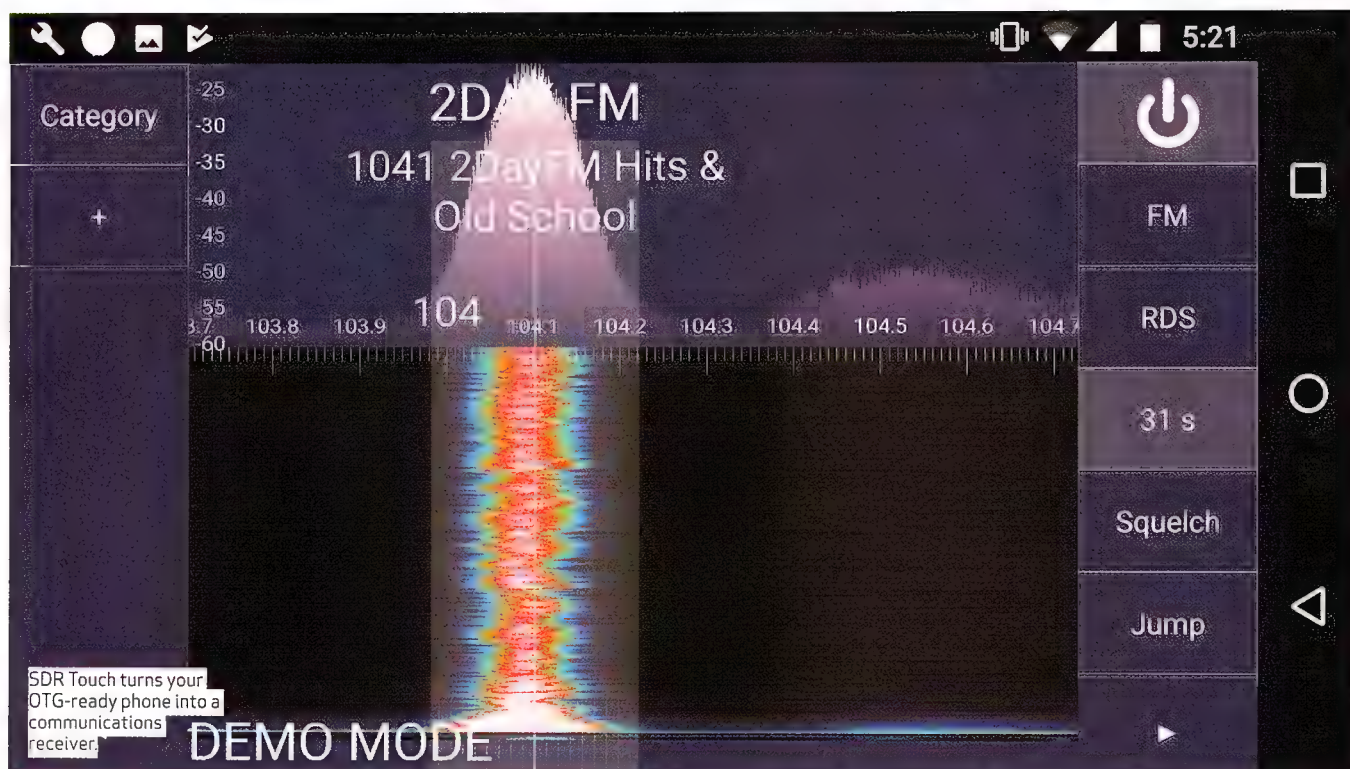


OTG cables for USB-C devices like the Galaxy A30 are now more common.

You'll need a DVB-T dongle with the RTL2832U chip to work on Android.







SDR Touch turns your OTG-ready phone into a communications receiver.

DEMO MODE



ANDROID COMPATIBLE  
USB OTG

[Details](#)

## What does this result mean?

This app tests if your Android software has the standard features from Google to manage an USB OTG device. If not it means that maybe the

- Grab a high-star USB OTG Check app from Google Play to check your device.

INSTALL

## BUT WAIT - THERE'S MORE!

Now even if you get through all that – your phone has OTG hardware, you've got the right version of Android and the OTG software drivers – you've still got to hope that your phone/tablet has supporting software drivers for your peripheral device. USB storage devices are pretty well covered, thanks to Android's support for the USB Mass Storage Class, which is why you can plug in a flash drive or portable hard

drive into your PC or Mac without any driver disk.

However, Android doesn't have the luxury of PC-size storage, nor has it always supported a generic series of USB Class drivers. For example, OTG may have arrived with Android 4.0, but USB Audio Class device support didn't appear until Android 5.0. Clever app developers got around this problem by writing their own USB Class drivers – no mean feat in itself. For example, the team at eXtream Software Development wrote their own USB Audio Class drivers to enable its USB Audio Recorder PRO app to run on pre-Android 5.0 devices (although the device still had to have OTG support).

It's a similar story for connecting external cameras to an Android phone or tablet – the device must include the USB Video Class (UVC) driver. Now as Google is quick to point out in its Android Developer pages, its UVC support is 'lightweight' – it's not designed for Augmented Reality (AR) or other high-performance applications. But that doesn't mean it's not still incredibly useful.

## FIVE FAVOURITE ANDROID OTG PERIPHERALS

Here are five of my favourite things to do with OTG that aren't expensive and add new functionality to any Android device.

### USB DIGITAL AUDIO

Android has supported USB Audio Class (UAC) since Android 5.0. However, the number of USB digital audio apps (just players, let alone recorders) is still comparatively low. With more recent

Android releases, it's now easier to route the internal audio stream to the USB-OTG port, where you can connect up a USB DAC (digital-to-analog converter) and hear high-definition sound that doesn't rely on your phone's internal audio architecture. Most Google player apps have OTG DAC support baked in. We mentioned it before, but we love USB Audio Recorder PRO – it's the only app we've found to turns your OTG-ready phone into a CD-quality digital recorder.

### USB MICROSCOPE

The first time most kids used to see a microscope was in Year 7 science, but these days, it costs very little to combine a VGA camera with a cheap plastic high-magnification lens to create a USB-powered microscope – in fact, less than \$20 on Ebay. Even better, the common stocky-barrel type unit being sold everywhere has been around for most of the last decade – and it supports USB Video Class drivers. However, Android compatibility isn't a guarantee and you may need to flit around with different UVC-ready camera apps on Google Play to find one that works. Apps we've had success with include Dashcam, CameraFi and UsbWebCamera.

### USB DVB-T TV

USB digital TV receivers are nothing new on the PC. However, they're not that common for phones or tablets. Who cares when you can stream free-to-air TV online, I hear you say. Well, what if you don't have 'online'? Or don't have spare data on your cap? Realtek's



RTL2832U DVB-T receiver chip is commonly found in USB dongles on Ebay for under \$15. Grab one of these and the Aerial-TV app (plus the driver app) from Google Play and you can watch TV, no internet and no data required. The other really cool thing this device can do is Software-Defined Radio. SDR has revolutionised the communications market, turning any PC or laptop into a communications receiver with similar features to stand-alone units that cost many hundreds of dollars. Now if you have USB-OTG, you just need the SDR Touch app from Google Play and you've got a receiver able to pick up unencrypted radio signals over a 20-1800MHz range. Just be aware that some radio signals are not legal to listen in on. Check your local laws before you go and do something dopey.

#### USB VIDEO CAPTURE

Phones and tablets clearly do video very nicely, thanks to their on-board cameras. But like audio, they're not great at being able to plug these signals into your device. Frankly, we were amazed that this trick actually worked, but it does. USB Video Capture dongles are almost as common as DVB-T dongles. In fact, pay more than \$15 for one on Ebay and chances are you've been duded. These generic 'EasyCap' dongles generally feature a choice of USB Video Class-ready capture chips, including the UTV007, STK1160 and others. We used the EasyCap Viewer app on Google Play (costs \$4) and it worked well with our UTV007 chipset dongles. You plug the dongle into an OTG cable and into your phone, fire up the app and you should be right. However, like a lot of OTG stuff, your mileage may vary.

#### USB CASSETTE TRANSFER

Marvel's *Guardians of the Galaxy* movie franchise may well be responsible for Philips' Compact Cassette having its second 'run in the sun', but if you were around for the first, you may still even have a few of your own mix-tapes lying

A USB microscope is a great learning tool and will cost you as little as \$15.



around. The problem these days is that most old cassette decks and players are failing, if not due to worn-out heads, then definitely due to perishing rubber drive belts. We've combined USB Audio Recorder PRO with this little bus-powered stereo cassette player to transfer music mix-tapes. The quality of our test unit was passable, although there was a small amount of motor noise in the background (which won't be a problem if you're into anything electric). This model sells by the bus-load on Ebay for under \$25.

#### HOW ABOUT CHARGING ANOTHER PHONE?

Yes, in theory, you can use USB-OTG to charge up one phone or tablet from another – providing the 'donor' device has the USB-OTG port. We've never really recommended doing it, though, for a number of reasons. Still, for completeness, we've given it a go.

We tested it by charging a Galaxy A30 phone from a Motorola Moto G5 and measured approximately 380mA of

charge current using a short OTG cable and the A30's supplied USB-C cable. At that current, it's certainly not going to be quick and the 'donor' device is likely to warm up a bit doing it. What's more, the donor device has to be powered up also for OTG to engage, so it'll be draining the donor battery as well. This is why we say 'in theory' – you'll get some charge doing this, but it's hardly the most efficient option.

#### TRY IT FOR YOURSELF

There's no doubt that USB-OTG is brilliant, but in our view, it's also a bit half-baked at the same time. In practice, it requires lots of steps to fall into place before it'll work. However, when all the planets are aligned, it can work really well and beats having to carry a full laptop around to do some pretty interesting stuff. So, check your Android devices, find out which are OTG-ready, get yourself an OTG adapter and see what you can do. ■

USB2.0 OTG adapter cables for older devices sell for \$2 on Ebay.



Burr-Brown's PCM2704 USB headphone DAC may fix your phone's audio.



# Monitor your network using a Raspberry Pi

Christian Cawley scans his network for intruders and unsafe hardware using little more than a Raspberry Pi and Nagios.

**N**etwork security is vital to the integrity of your data and hardware. Using a router with a firewall and computer security tools is wise, but to get a better idea of what's happening on your network, you'll need a monitoring tool.

It might seem like the stuff of low-budget cyber thrillers, but a network monitoring tool can be effortlessly set up and put to work pinging the hardware on your network and scanning for intruders. This essentially means that you can learn right away when your devices on your network go offline (perhaps IoT or smart-home applications), and discover unauthorised connections to your router or other networked hardware. All you need is a Raspberry Pi and the Nagios software.

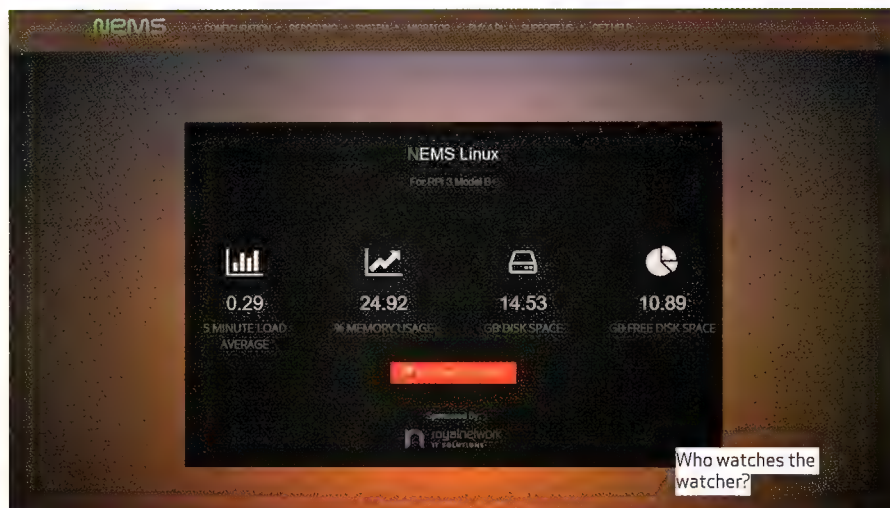
Two versions of Nagios are available. There's the Nagios XI series of premium products, which might be more suited to corporate use. These feature a trial period and technical support. Nagios also comes as an open source suite, with four options: Nagios Core, Nagios Core Plugins, Nagios Core Frontends (community-generated UIs) and Nagios Core Addons to extend functionality. Once installed on a single device, Nagios brings continuous monitoring to your network, regardless of its size and dynamic.

Continuous monitoring is a staggeringly useful concept that all too few businesses take the time to implement. It basically enables the detection of network and server issues almost as they happen. This prompt detection enables fast diagnosis, thus minimising downtime.

With the open source version of Nagios, it's possible for anyone to apply this level of monitoring to a network. It doesn't matter whether you're running a home network, a social club, or you're the system admin for a healthcare provider. Install Nagios on a Pi, configure monitoring and notifications, and network management is immediately levelled up.

## START BEING A NAGIOS

As noted, various versions of Nagios are available; this is true for the Pi versions



too, where different builds have been released over the years. For simplicity, we're going to look at two options: installing a dedicated disk image, and installing manually to your existing OS.

NEMS for the Raspberry Pi stands for Nagios Enterprise Monitoring Server, and is available from <http://bit.ly/1xf253nems>. It requires an SD card of at least 16GB, with 32GB recommended. A Raspberry Pi 3B+ is recommended, although almost any version apart from the Raspberry Pi 1 Model A and Raspberry Pi Compute Modules should work. Note that the NEMS build can only be downloaded using a Bittorrent client. Other Nagios disk images are available, however.

Once downloaded, use your preferred disk imaging tool to write the IMG file to the SD card. For simplicity, the open source cross-platform Etcher tool from Balena ([www.balena.io/etcher](http://www.balena.io/etcher)) is the best option if you're using a desktop environment.

All you need to do is download and install the tool, insert the SD card in your computer, select the disk image, confirm the correct drive is selected, and click Flash. Note that this will reformat and overwrite the SD card. A few moments later, NEMS will be ready to run on your Raspberry Pi.

Next, connect your Raspberry Pi to your router via Ethernet. While NEMS can use Wi-Fi, Ethernet is a more reliable medium for network monitoring. Insert the SD card, then

boot up the Pi and wait while NEMS configures. This will involve the filesystem automatically resizing, so the initial boot will be longer than usual.

Using SSH, connect to NEMS using `nemsadmin` as the username and password. Then run

```
sudo nems-init
```

This will start the NEMS setup. Here, you'll need to set the correct locale, encoding options, and create an account. This includes adding an email address to which notifications will be sent. In your desktop browser, open <https://nems.local> (or use the Pi's IP address) to start configuration.

## NAGIOS IT YOURSELF

Alternatively, you can install Nagios manually to your Raspberry Pi's existing operating system, Raspbian or otherwise. For the best results, start with a fresh OS install, then open a terminal or start an SSH session. First update and upgrade:

```
sudo apt update && sudo apt upgrade
```

Be sure to follow this with a reboot.

```
sudo reboot
```

With the Pi restarted, install Nagios:

```
sudo apt install nagios3
```

Wait for prompts to create an admin account, keeping note of the password as you'll need this later. The installation will continue for a short while after this. When done, you'll be able to access Nagios from another device using the



Last login: Wed Jun 12 07:47:03 2019 from 192.168.1.210



LINUX

BY: ROBBIE FERGUSON  
NEMSLINUX.COM

```
NEMS Platform...: RPi 3 Model B+
NEMS Version...: 1.5 (Current Version is 1.5)
NEMS IP Address...: 192.168.1.78
Uptime.....: 0 days 0 hours 1 minutes 46 seconds
Load.....: 1.58 (1 minute) 0.88 (5 minutes) 0.34 (15 minutes)
              0.22 (1 week)
Memory.....: Total: 927 MB / Cached: 99 MB
              Used: 214 MB / Free: 98 MB
Disk Usage.....: You're using 25% of your root filesystem
```

The NEMS terminal screen. Pretty, isn't it

nemsadmin@nems:~\$

Pi's IP address, such as <http://192.168.1.10/nagios3>. Use the `nagiosadmin` username and the password you created earlier when you're prompted.

### GET MONITORING

With Nagios installed on your Raspberry Pi, you have a continuous monitoring system ready to run. All that's left to do is to configure it for your purposes. If you've set up manually, you can configure a host via the terminal. Start by creating a configuration file; ours is called `monitor.cfg`.

```
sudo nano /etc/nagios3/
conf.d/monitor.cfg
```

In this file, add the details that relate to the device you wish to monitor. For example, I have a Raspberry Pi hosting

a Minecraft server:

```
define host {
    use         generic-host
    host_name   minecraft
    alias       minecraft
    address     192.168.1.22
}
```

The `generic-host` used is a template found at `/etc/nagios3/conf.d/generic-host_nagios2.cfg`. Templates can be used to save time when creating device-monitoring settings. To save time, all you should need to do is create multiple entries based on this definition, changing the `host_name`, `alias` and `address` to the device you're monitoring.

Hit Ctrl-X to save and exit, then reload Nagios:

```
sudo service nagios3 reload
```

If you run into any problems, check for errors with:

```
sudo /usr/sbin/nagios3 -v /
etc/nagios3/nagios.cfg
```

This will ensure your config files are correct. Remember to reload Nagios again after checking.

Monitoring can be observed via the browser; indeed, you might consider leaving this open. Or you could simply run it on your Pi's desktop, ready for remote observation via VNC.

Nagios configuration can also be conducted using your web browser. In the browser, open the Configuration menu and find NEMS Configurator. Find Hosts in the left-hand menu and click Add. Next, add the host details with the same credentials as you would manually. Add any necessary notifications, then Submit to save.

Use the Reporting menu to keep an eye on performance. Two key views are available. Adagios is a modernised user interface, while Nagios Core relies on a legacy view that dates back a few years. Both are entirely usable, however.

The full power of Nagios is considerable, so take the time to explore the features, add your networked devices, check logs, switch visualisations and more. If you're using NEMS, you can easily configure a host via the browser interface in the same way.

That's all there is to it – your Raspberry Pi Nagios box is now set up for monitoring. It can be left running in the background indefinitely, ready to alert you to any problems with hardware connectivity and suspicious activity on your network. ■

## What if Your Server Locks Up?

As you might know, the Raspberry Pi is prone to the occasional lock-up. When the system freezes, monitoring will cease. Short of ensuring a constant power supply and using a top-rated SD card, there is little you can do to stop this. You might set a cron job to reboot Nagios, or you could rely on a HAT designed to control whether your Pi is powered up, rebooted or shut down.

Compatible with most Pi models (including the Pi Zero) and with support in NEMS, PiWatcher is described as "the best watchdog for your Raspberry Pi" and sits neatly on the first six pins of the Pi's GPIO. Used in place of the board's built-in USB power port, PiWatcher is a programmable watcher circuit that can be configured via the I2C. Where it comes in useful for a locked-up computer is that it can be programmed to reboot the Pi should the computer become unresponsive. This is based on a user-specified time limit, but there's also a built-in switch for manual shutdown (and subsequent reboot) if necessary. As the switch is programmable and the PiWatcher can be easily reconfigured, it has uses beyond basic monitoring.

Note that you'll need to solder the included 2x3 female pin header to the PiWatcher before use. Head to the Omzlo online store to check the documentation and order one <http://bit.ly/lxf253piwatcher>.



# Finding your data

Machine-learning is many things, but it's nothing without data. Darren Yates looks at where to find data, how to make your own and the dramas behind how it's being used.

**I**n some ways, if you're worried about machine learning taking over the world, you can shut the gate – it's already happening. It already helps choose the videos you stream, the stuff you buy, even who you'll date. Over the last year, we've looked at different ways you can execute machine learning algorithms, from coding with R and Python, to not coding and using a GUI-based tool like Weka instead. In the end, however, it doesn't matter what your preferred option is if you don't have data – and its society's insatiable desire for data that now drives industry, governments and research forward.

## NO SILVER BULLET

Although we talk freely about 'artificial intelligence' and machine learning these days, they're still often seen as black boxes that perform the sort of magic you'd read of in a *Harry Potter* book. But like most things, machine learning can only work with what you give it and if you feed it poor, irrelevant data, the chances are high the results you'll get won't be great. In other words – rubbish in, rubbish out. That's why the vast majority of time in many machine learning projects is spent on data – acquiring it, processing it and making sure it's in the right form that a machine learning algorithm can work with.

## THE TROUBLE WITH DATA

You don't need a degree in rocket surgery to know data is everywhere – and in fact, that's the main problem with it. IBM came out with a stat a few years ago that 90% of the world's data is being generated in the previous two years. So the problem isn't having enough data, but finding the right data. Just quickly, there are three broad ways to find data – you can set up or trawl your own sources of data (sensors, logs etc), you can find existing 'open' data online, or you can make your own ('synthetic data' is often used in preliminary research).

One extreme example of 'setting up your own sources of data' is the Sydney Harbour Bridge. The CSIRO's



The CSIRO has 2400 sensors monitoring the health of the Sydney Harbour Bridge (Source: Adam.J.W.C., Wikipedia, CC-BY 3.0).



Data61 has set up 2,400 sensors on the bridge to monitor the health of the structure. The data streaming from these sensors is analysed for damage detection and load assessment to work out the right schedules for maintenance.

That's a pretty straightforward example – where things get more difficult (and rightly so) is when we start talking about the data of humans. From the minute we're born, we begin leaving a trail of data – data that's of increasing value to not just business, but governments

and research. But there are differences in how your data can be gathered.

For example, any form of academic research involving human subjects first requires ethics approval of the originating university before the research can begin (a process that can take several months). Yet, when it comes to industry, we're seemingly more relaxed about our data. As a quick test, ask yourself the last time you read through an end-user license agreement when signing up with an online service. Chances are you



The UCI data repository stores datasets from a range of domains.

Browse Through: 476 Data Sets

| Name                             | Data Types   | Default Task        | Attribute Types            | # Instances | # Attributes | Year |
|----------------------------------|--------------|---------------------|----------------------------|-------------|--------------|------|
| Abalone                          | Multivariate | Classification      | Categorical, Integer, Real | 4177        | 8            | 1995 |
| Adult                            | Multivariate | Classification      | Categorical, Integer       | 48842       | 14           | 1996 |
| UCI Annealing                    | Multivariate | Classification      | Categorical, Integer, Real | 768         | 38           |      |
| UCI Anonymous Microsoft Web Data |              | Recommender-Systems | Categorical                | 37711       | 294          | 1998 |
| Arrhythmia                       | Multivariate | Classification      | Categorical, Integer, Real | 452         | 279          | 1998 |
| Artificial Characters            | Multivariate | Classification      | Categorical, Integer, Real | 6000        | 7            | 1992 |
| Audiology (Original)             | Multivariate | Classification      | Categorical                | 226         |              | 1987 |

"You don't need a degree in rocket surgery to know data is everywhere – and in fact, that's the main problem with it."

probably haven't. Yet, the terms and conditions can often allow your data to be shared with third-parties for commercial purposes. That said, the recent furore over FaceApp and its broad licensing terms suggests we're starting to wise up about data privacy.

That also goes for increasing concerns about how governments are using data. For example, the Centrelink 'robo-debt' automated debt recovery saga shows what can happen when data acquisition and analysis goes pear-shaped. However, not to be deterred, reports are 'robo-debt v2' is being ramped up to now include data matching from Medicare ([tinyurl.com/y693od5t](https://tinyurl.com/y693od5t)).

[com/y693od5t](https://tinyurl.com/y693od5t)).

Still, other branches of government are fighting for your rights. The Australian Consumer and Competition Commission (ACCC) has recently locked horns with tech giants Facebook and Google via the Digital Platforms Inquiry, with an aim to limit how tech companies, among other things, collect and use your data ([tinyurl.com/y2hshkne](https://tinyurl.com/y2hshkne)).

It'll be well worth keeping an eye on how a regulatory framework for data protection unfolds over the coming months – there'll be plenty of lobbying from both sides.

## OPEN DATA

Governments are also leading the way when it comes to opening up data. The [data.gov.au](https://data.gov.au) website is a one-stop shop for all open data available from Australian federal government sources. One of the biggest (and least known) government data initiatives is the Geocoded National Address File (G-NAF). It contains the records of over 13 million physical Australian addresses around the country in a series of relational data files. Each address includes geo-location data, there are rules on how the data can be used, but it is openly and freely available to download from the [data.gov.au](https://data.gov.au) website.

It's not just Australia making large lakes of data available, either – the U.S. has its own [data.gov](https://data.gov) website and you'll find international agencies such as the World Health Organisation have open data repositories as well ([tinyurl.com/y45bjqr5](https://tinyurl.com/y45bjqr5)).

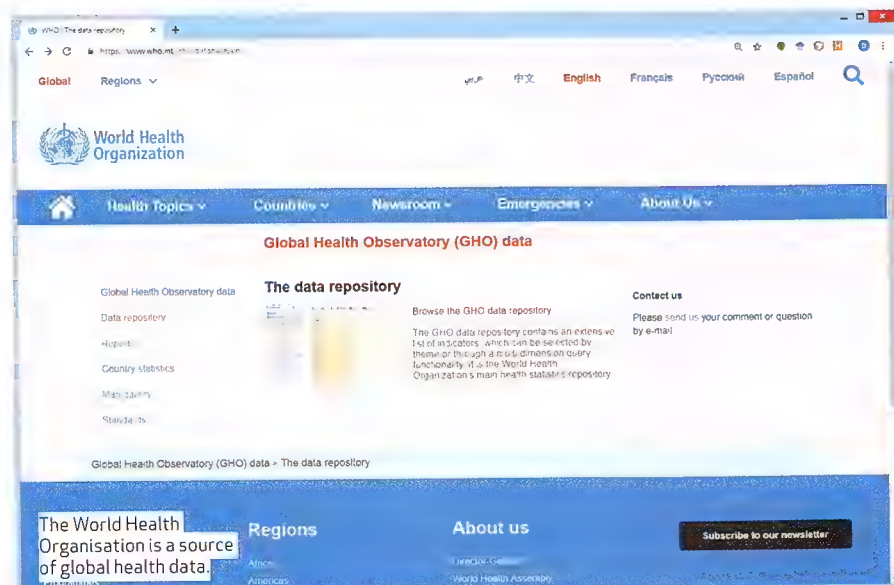
In fact, open-source data forms the backbone of much research, particularly when it comes to machine learning research and development. One of the most popular sites is the University of California, Irvine (UCI)'s data repository where data on a range of topics from medical to gaming are available for download ([tinyurl.com/y5o6egcc](https://tinyurl.com/y5o6egcc)).

## ASKING THE RIGHT QUESTIONS

As you can see, finding data isn't the problem – it's finding the right data that makes the task of machine learning a tougher assignment. That's why in solving any data problem, it's actually important to talk to the people in the know about the situation you're trying to solve. In machine learning circles, they're called 'domain experts'. They help you know which questions to ask, the things you need to know and from there, you can start sourcing the right data.

## DATA NEEDS TO BE RESPECTED

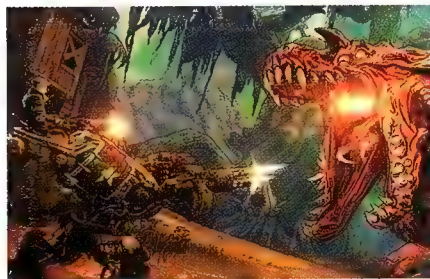
The bottom line is that as usual, the tech has raced ahead and we're only now catching up to the ramifications. The reality is we enjoy the fruits of machine learning our data, but as with all tech, there'll always be positives and negatives. The difficult task for all of us is to find the balance that gives business, government and research access to data, but also respects the privacy of that data. New techniques such as 'differential privacy' are being researched that may help. In the end, though, we'd probably all like a rule that says 'handle other people's data with the same respect you'd like them to handle yours'.





# downtime

WHAT'S HAPPENING IN THE WORLD OF FUN.

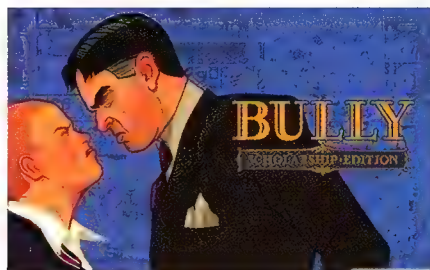


## Borderlands 3 will let you prioritise graphics or frame rate on PS4 Pro

**THIS GRAPHICS SWITCH WILL LIKELY BE AVAILABLE ON XBOX ONE X AS WELL.**

As consoles become more and more like PCs – that is, increasingly powerful and with multiple versions available – once PC-only optimisation settings are becoming more common. As Gearbox online and social producer owner Scott Velasquez explained in a new *PlayStation Blog* post, *Borderlands 3* is the latest game to offer PC-like graphics options – at least on PS4 Pro.

“The PS4 is an amazing console, but the PS4 Pro takes things to another level and allows us to push the game further by running at higher resolutions and higher framerates,” Velasquez said, adding that *Borderlands 3* will support 4K and HDR output on PS4 Pro as well.



## A next-gen Bully sequel is in the works for 2020

**ANOTHER SET OF BULLY 2 LEAKS HAVE ARRIVED, BUT WE'RE STILL NOT 100% CONVINCED.**

The first piece of evidence for this rumour came via *Polygon*, who reported on the Easter egg with a curious url – “bully-sequel-announced-fall-2020-news-embargoed-do-not-publish” – visible in the search bar. Most wrote this off as a silly, not so subtle joke, but others took the url as a potential leak of *Bully 2*'s existence.

Fast forward to this week, and *Bully* obsessed YouTube channel *SWEGTA* reports (via a Rockstar Games insider source) that *Bully 2* is indeed being developed for the next generation hardware on a 2020 release schedule, with *ComicBook.com* also corroborating the same thing via their own internal sources. Yeah. Sure.



## Call of Duty: Modern Warfare will provide dedicated servers on all platforms

**Crossplay for all platforms has also been confirmed.**

**C**all of Duty fans, you can finally rest easy: *Call of Duty: Modern Warfare* will have dedicated servers and support crossplay at launch. According to a *Game Informer* cover story (via *Charlie Intel*), Infinity Ward and Activision are confirming that alongside full crossplay support for PC, PS4, and Xbox One, *Modern Warfare* will feature dedicated servers to ideally help ensure stability at launch and beyond.

Dedicated servers aren't anything new to *Call of Duty*, but with the introduction of crossplay support to the franchise with the upcoming *Modern Warfare*, it's even more crucial to ensure stable server performance by forking out for dedicated servers. With the pervasive issue of server instability in online competitive gaming, it's a big relief to hear it's quickly becoming commonplace for AAA developers to address the issue before it becomes an issue.

Of course, the announcement of dedicated servers is far from a 100% guarantee that *Call of Duty: Modern Warfare* will launch completely free of server problems, especially with the series' patchy history in that regard. Regardless, it's certainly a step in the right direction.

## Final Fantasy 14's main story will become “more compact” in a future update

**HOPEFULLY THAT MEANS “LESS PADDED”.**

In a recent Q&A (translated on the Square Enix forums), game director Naoki Yoshida – aka Yoshi-P – explained that “we’re working on adjusting the A Realm Reborn main scenario to be more compact, and are aiming [to release these changes in] patch 5.3.” He didn't explain how exactly the story will be condensed, but it's easy to see how it could – and, some might say, should.

Without wishing to spoil, *Final Fantasy 14*'s base story boils down to fighting elemental Primals, collecting magic crystals, and uniting leaders. Oh, and vanquishing an evil dude in a mask. It's simple, but it works. It's got some funny lines, a few gut-punch moments, and some great boss fights. The problem is that the main scenario quests that make up the story are overflowing with boring and repetitive fetch quests, ‘talk to me’ quests, and kill quests for monsters you've long since out-leveled.

I've recently gotten into *Final Fantasy 14* and am currently playing through the main story myself, so I speak from experience when I say it has a bad habit of slamming the brakes every time things finally get going.





## The developer of 1,000-player battle royale Mavericks: Proving Grounds has gone bankrupt

**Mavericks, the battle royale with open-world RPG aspirations, ends development.**

The battle royale game that promised to let 1,000 players fight to be the last one standing across an ever-evolving world didn't stick the landing. Automaton, the developer of *Mavericks: Proving Grounds*, announced in an update to the bottom of its website that the studio has entered insolvency (bankruptcy in US legal parlance).

"Please be advised that due to insufficient funding, the development of the *Mavericks: Proving Grounds* game has now ceased," the website states. "The joint administrators are in the process of licensing the *Deceit* game so there will be no change in the live operation and provision of this game."

*Deceit* is an online shooter that combines multiplayer action with elements of social deduction games like *Mafia/Werewolf*. It was the only game to be fully released by developer Automaton since the studio was established in 2015, though it was also teasing another concept called "Project Y: Next-Generation Fantasy".

## Overwatch addresses major gameplay concerned

**GOATS to go.**

For several months gamers have felt the aggravation of an unbalanced *Overwatch* match, as the dreaded GOATS meta held the game in a vice-like grip. GOATS is a style of play where teams run three support players and three tanks, completely ignoring the damage per second (DPS) slots. It's super effective but incredibly boring, as three massive, usually shield-bearing tanks meander towards capture points while being endlessly healed from support players hiding behind their hulking frames. It's been a dominating force in gameplay for the last several months – such a force that people have quit the game out of frustration.

Enter role queue, which requires both teams to bring a balanced 2-2-2 (two DPS, two tanks, two supports) format to every game. It's dramatically changed the way *Overwatch League* is played, inciting the resurgence of heroes that have long lay dormant while GOATS reigned supreme. Overall, the responses to the role queue announcement have been mainly positive, with some people suggesting the *Overwatch League* is dictating the game's format for all, and others commending Blizzard for making the game fairer.



## PlayStation 5 imminent?

**NEW LEAK CLAIMS PS5 WILL BE REVEALED IN FEBRUARY 2020.**

A leaked marketing email from Sony apparently refers to a "PlayStation Meeting 2020" that's set to finally reveal the PS5 in all its glory. This meeting, according to the rumor, will take place on February 12 next year, and is designed to showcase "the future of Sony PlayStation to the whole world".

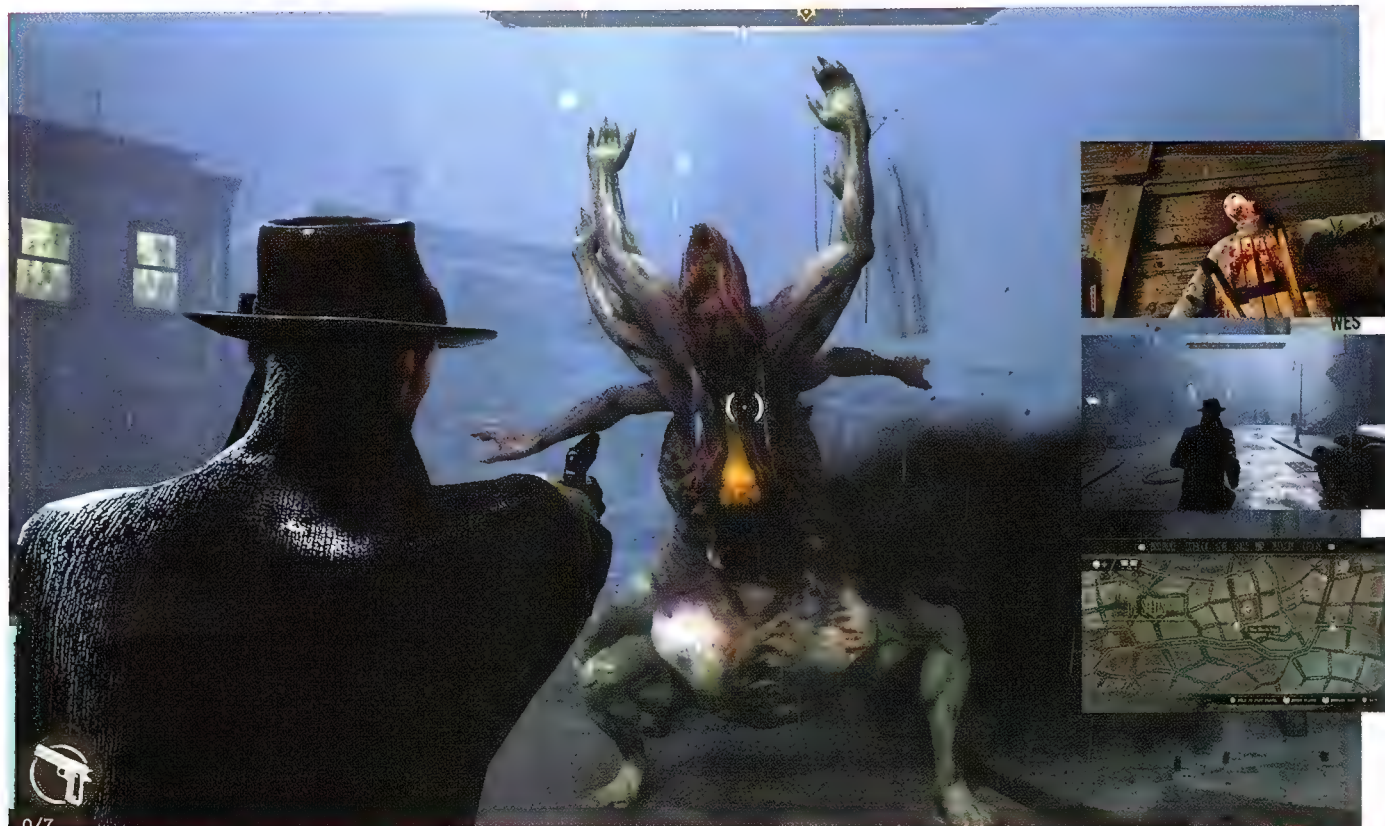


## Skateboarding games finally return

**GET READY TO TAME SOME CONCRETE.**

Indie studios Crea-ture has officially announced its skateboarding title *Session* will be available on Steam Early Access as of September 17. Created by skateboarding enthusiast and Crea-ture co-founder Marc-Andrew Houde, *Session* takes the skate game format, replacing button combos with a completely new system – True Stance Stick control, which maps the analog sticks to your skater's feet. We're ready for the learning curve. ■





£99.95 | PC, PS4, X81, SWITCH | [THESINKINGCITY.COM](http://thesinkingcity.com)

# The Sinking City

A detective game with a Lovecraftian twist.

**T**he *Sinking City* is a third-person detective adventure set in a fictional version of 1920s New England, inspired by the works of influential (and, yes, controversial) horror writer H.P. Lovecraft. Divers uncover an ancient cavern hidden beneath Oakmont filled with otherworldly statues of cosmic demons, and are driven mad by the discovery – a madness that begins to spread through the city and awakens strange, violent creatures the locals call wylebeasts. The game is divided between solving crimes and shooting monsters, although the gulf in quality between each flavour of play is pretty wide.

As you explore a crime scene you collect clues that, while useless on their own, can be connected in the Mind Palace to open up new

lines of investigation. And you have to make these connections yourself, without any hand-holding or hints, which makes a successful deduction very satisfying. But while Sherlock Holmes has to rely entirely on his intelligence and intuition to solve a mystery, Reed has a supernatural advantage. In certain locations a glowing blue portal will open up, through which he can witness whichever crime transpired there. These vignettes come in the form of shimmering silhouettes of the people involved and fragments of speech. Reed must then construct a narrative, figuring out the order these echoes of the past occurred in, which will usually result in a new clue appearing in the Mind Palace.

My biggest issue with *The Sinking City*, at least as a detective game, is that the

cases aren't that interesting. I rarely felt any compulsion to forge on here, and the solutions to many of the cases lacked a satisfying 'aha!' moment – the punchline that should round off any good detective story. In leaving Holmes behind, the developer's knack for writing a solid mystery seems to have suffered.

There's a simple crafting system in there too, letting you make health kits, ammo, and other useful items from scrap gathered in the world. But, like the combat, this is all rather rote. I feel like *The Sinking City* would be a better, more consistent game if it focused purely on the detecting aspect.

There's some nice world-building, including districts that have been almost completely submerged, with only the tops of lamp posts poking out of the murky water. But overall the city feels disappointingly lifeless,

with robotic NPCs wandering aimlessly, repetitive scenery, and a forgettable, droning soundtrack adding to the sense of gloom. There's a good, but not great, detective game lurking here, but as a package, it doesn't quite work. The open world isn't interesting enough to compel you to explore it, the combat is basic and uninspiring, and the writing and construction of the mysteries are generally quite poor.

■ Andy Kelly

## Verdict

An occasionally entertaining detective game blighted by poor writing and rote combat.







\$99.95 | PC, PS4, XB1 | CODEMASTERS.COM

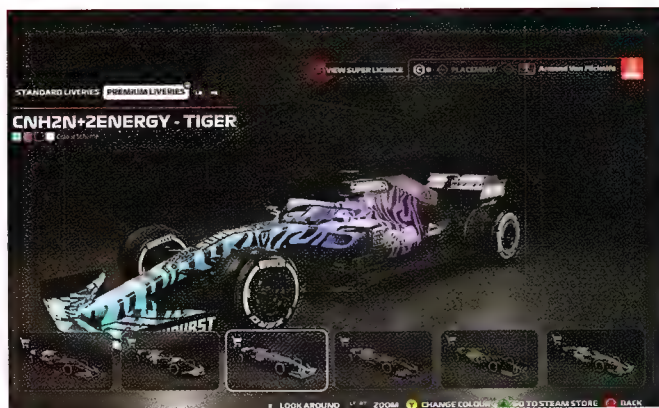
# F1 2019

It spins our wheel with scripted drama and F2 racing.

The best way for an annualised, licensed motorsport game to stay fresh every summer when the latest iteration trots out onto the Steam Store is, clearly, to chuck in an entirely different racing series as well. With the inclusion of the 2018 F2 championship, *F1 2019* feels for the first time in the series like a wider world of motorsport, offering that irresistible rags-to-riches journey in career mode and a handling model all of its own to master.

But it needed to add something more than a few handling tweaks, and it did just that by placing a tier of racing below F1 and thus making a contract with the big boys feel like more of a big break. The way it's brandished in *F1 2019*'s career mode is a bit of a surprise, though. Rather than a full season of F2 racing, it's a scripted sequence of condensed race highlights akin to Codemasters' beloved *TOCA: Race Driver* which kicks off your journey to F1.

Barely half an hour passes before you're spat out of the



other side of F2 and picking an F1 team. It's possible to participate in a separate F2 season mode – which has no bearing on your career – but it would have been nice to have the option of working a bit harder for your F1 race seat. As it is, choosing your F2 team determines the level of interest you'll receive from various F1 teams, so your choice does at least feel meaningful even if the season's fleeting.

A new leagues system and improved race highlights mode both bolster *F1 2019*'s esports cred, but I'm still not totally sold on the virtual stewards and how they dole out penalties. This isn't a tangible leap forward in the fundamentals of the F1

series – the handling and visuals remain roughly where they were last year, which is to say: excellent. What Codemasters has managed to add into the series in an impressively short span though is a wealth of new solo content that enriches career mode and offers a totally different challenge outside it. ■

Phil Iwaniuk

## Verdict

Goes beyond what anyone could expect of an annualised series.



## Missed Messages

Trying desperately to save a friend.

FREE | PC, LINUX, MAC | [BIT.LY/MISSMESS](http://bit.ly/missmess)

You're sat at your computer, trying to write. You probably shouldn't respond to the instant message that's just popped up. That's the premise of *Missed Messages* – a gorgeous and affecting visual novel.

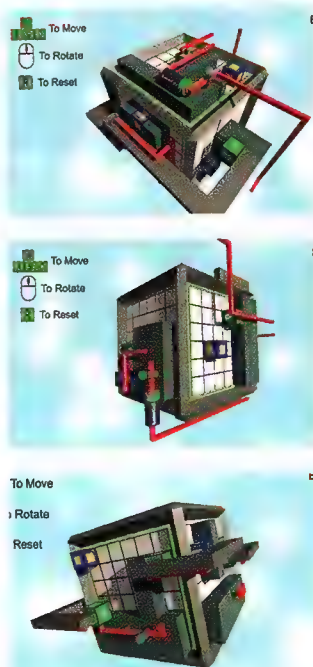
You have plenty of choices to make, however, curiosity's lure will surely make that first one for you – getting to know the mysterious stranger who is suddenly chatting you up. As you playfully yammer, first on your computer and then on an actual date, something terrible is happening back at your apartment. When you return, you find a cryptic note. While you were out having fun, she has taken her own life. If only there was something you could have done.

No one decision feels particularly momentous here. Instead, there seems to be an avalanche of small choices carrying you to one of the four endings, which feels subtler and, again, more like real life. Mental illness, I think, is one of gaming's favourite topics but few explore it at surface level, or with as much skill as in this lovely visual novel. ■

Tom Sykes







## Cirkoban³

Get owned by cubes, Sokoban-style.

FREE | PC | [TYKENN.ITCH.IO](http://TYKENN.ITCH.IO)

Where *Cirkoban³* differs from the majority of Sokoban-likes is its incorporation of the third dimension. Rather than a single, flat game board, there can be up to six in play here, as you hop from side to side of a 3D cube. Every side has its own blue, player block, which will spring into action when the player focuses on it, by swivelling the mouse. Pushable green blocks, meanwhile, are not just glued to power lines but to chunks of scaffolding, which curve around the edges of the cube. As green blocks are often linked to one another, you may find that pushing one horizontally causes another to move vertically on an adjacent side. It's an inspired if awkward evolution of the block-pushing concept. Despite containing only eight levels, *Cirkoban³* wrings a lot of tasty puzzling from its central concept. I was left with a big smile on my face after finally wrapping it up. ■

Tom Sykes



\$69.95 | PC, PS4, XBI, SWITCH

# Bloodstained: Ritual of the Night

A homage to *Castlevania* games by one of its creators.

**M**iriam is a science experiment in the shape of a doll-up anime girl. Together with her friend, a man named Gebel, she was part of an experiment that transplanted the essence of demons into her body. This demonic power comes in the form of shards, thus she's called a Shardbinder. The more shards you absorb the more you let go of your humanity, a fate that befell Gebel.

Combat is the main focus, and on normal difficulty most enemies don't pose much of a threat. Early on a nice rhythm between exploration and combat builds, and feels very genre-specific in the way you anticipate the respawning enemies and find increasingly fun, increasingly quick ways to deal with them.

The various shards you collect by repeatedly killing monsters of the same type are infrequently necessary for progression and almost exclusively exist for fun and variety. I can't stress enough how *Bloodstained* is brimming with stuff at all times. Shards come in the



form of summons, projectiles and special attacks and almost every weapon that conceivably made sense to put into the game. Additionally, there's no way to attack up or downwards, which is the ultimate proof *Bloodstained* was designed as a throwback experience. Your bursting inventory doesn't win points for usefulness as much as it simply appeals to the part of our brains that wants to collect all the things. Finding your way around can stump you sometimes, but backtracking is made easy through genre-typical fast travel rooms.

*Bloodstained* is likely to appeal to newcomers, but, like the vampires it so

reverses, it's starting to feel long in the tooth when compared to the innovation found elsewhere in the genre. It's a neat little capsule of a game, an amusing diversion with a flow that makes time flow swiftly until you're brickwalled by a boss, but it's the very definition of been-there-done-that if you've ever played a *Metrodvania* before. Sometimes that's all you want. ■ Malindy Hetfeld

## Verdict

A feast for fans of a very specific experience; but too old-fashioned for anyone else.







\$32.99 | PC, PS4, PS3 | WWW.QUANTICDREAM.COM

# Heavy Rain

An atmospheric murder mystery that frequently shoots itself in the foot.

**H**heavy Rain is an adventure game of sorts, with a heavy focus on Shenmue-style QTEs. That means a lot of button-tapping and stick-wagging, whether it's one character shaking a carton of orange juice before taking a swig or another swinging a fist in a punch-up. Occasionally you can wander around freely, and the environments are beautifully detailed. But most of the time you're watching cutscenes, deciding how they play out via a series of timed, reaction-based button prompts.

What makes *Heavy Rain* worth playing despite its amateurish, hole-ridden plot, inhuman dialogue, and

inconsistent tone. It's actually one of the most twisting, structurally complex, and reactive interactive stories on PC. While a Telltale game will let you carve your own path to a single ending, with only slight variations, it's actually possible for every main character to die in *Heavy Rain*. And the final outcome will be wildly different depending on the many choices you make across its ten or so hours of play.

The plot is *Baby's First Thriller* and the characters are humourless and hard to love, but there's no denying that this is an interactive story in the truest sense. For one, it's incredibly pretentious. It thinks it's telling a searingly mature,

provocative story, but cheapens this constantly with schlocky Saw-inspired shock horror, the frequent and gratuitous sexualisation of Madison Paige, and one of the most rushed, unconvincing, and cack-handed romances in the history of fiction.

*Heavy Rain* is almost a decade old, originally appearing on PlayStation 3, but was recently remastered for a PS4 release with improved textures, models, and lighting – which is the version we get on PC. The story is genuinely interactive, with many branching paths and sudden deaths, as well as a slew of different endings. In that sense, I really enjoy playing it. But as a piece of storytelling, and as a murder mystery, it's really quite poor.

■ Andy Kelly

## Verdict

Poorly written and not as smart as it thinks it is, but has a genuine sense of choice and consequence.



## Dear Substance of Kin

Rewrite fate.

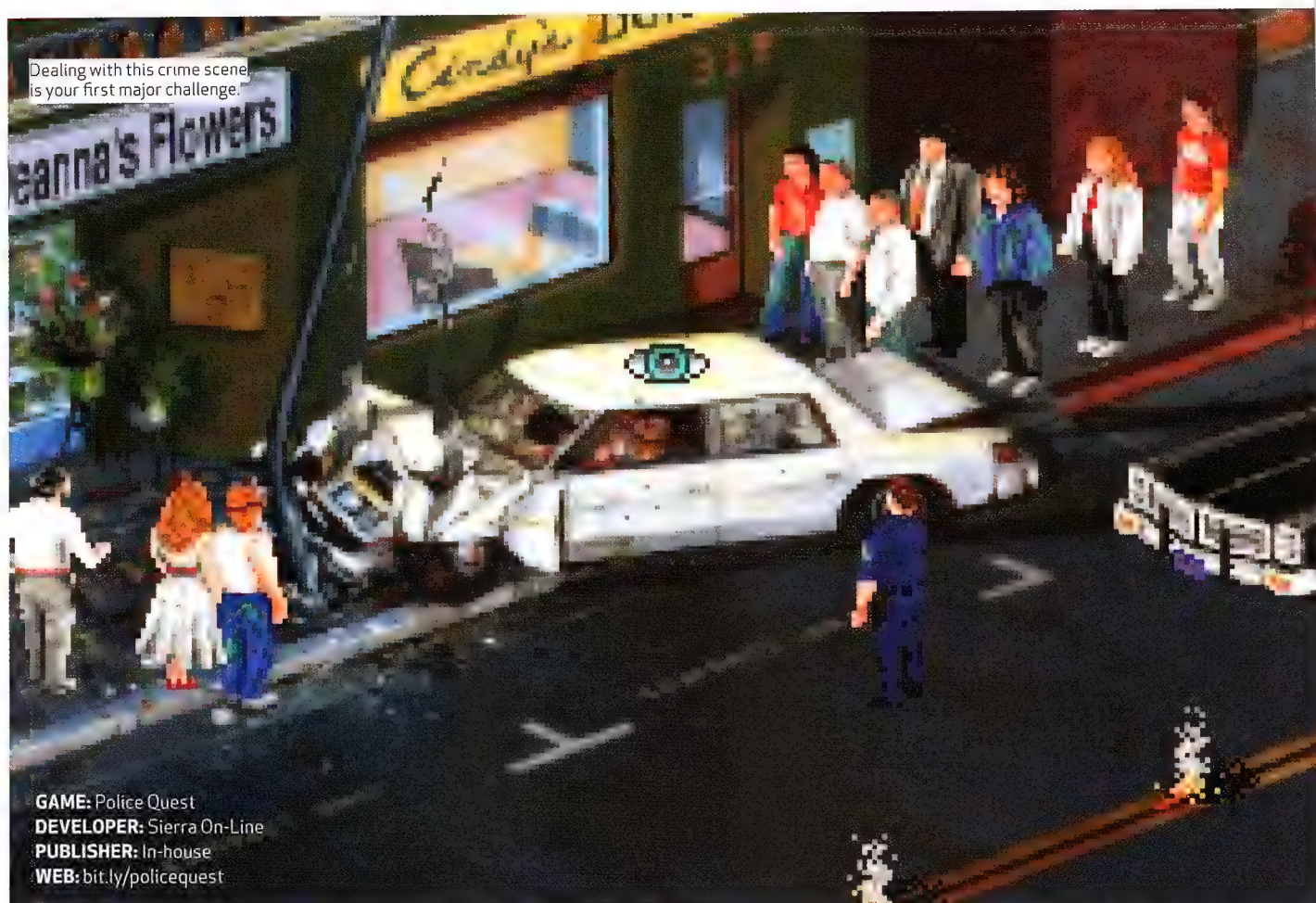
FREE | PC | DECONSTRUCTTEAM.ITCH.IO

*Dear Substance of Kin* imagines a world where our destinies are etched onto our backs, in invisible fate lines that only a wandering mystic can see. By getting a load of blood and scribbling out these destiny lines, a coppersmith may rewrite a person's fate. You are a coppersmith offering your services to an assortment of miserable peasants. First you visit a hovel, then you engage its owners in conversation, seeking out the element of reality they would like to change. It might be a desire for food, or violence, or the power of flight. It's up to you to figure out how to achieve this, based on what they've said. Using sacrificial blood, you'll scrub out one or more fate lines, before leaving to go and tend to someone else. It's an excellent premise for a grim-dark fantasy story, realised with hurried but poetic dialogue and grungy pixel art. The evocative setting reveals just enough to intrigue – but without explaining how our actions will affect the world. ■

Tom Sykes







# Police Quest

Andy Kelly revisiting Sierra's classic cop adventure.

*Police Quest* was a collaboration between developer Sierra On-Line and retired police officer Jim Walls. When it was first released, most videogames were either fantasy or science fiction. But this was (and still is) unique in that it saw you stepping into the shiny black shoes of a regular traffic cop. Walls wanted players to experience the mundane reality of the job, as well as the car chases and shootouts. The result is a game laden with often stifling procedure, where failing to play things by the book can result in you being fired or, if you really screw up, killed. Sierra often boasted in the series' marketing material that the *Police Quest* games were used to train real cops.

Set in the fictional town of Lytton, California, *Police Quest* follows the adventures of one Sonny Bonds, an easygoing traffic cop who gets tangled up in a case involving a drug kingpin known as the Death Angel.

## THE NAKED GUN

*Police Quest* is a fairly standard point-and-click adventure, at least in terms of how you interact with the world. There are no item combination puzzles or other familiar trappings of the genre here, and Bonds doesn't wander around with a pocket full of random objects in the hope that one of them might come in handy. Figuring out how to deal with dangerous situations in a way that is both safe and by the book is where the challenge lies. And, being a Sierra game, there are dozens of ways to die or otherwise end the game.

A good example of this, from the early hours of the game, is when a local business owner asks Bonds to visit a nearby bar and tell a gang of bikers to move their motorcycles from the front of her cafe.

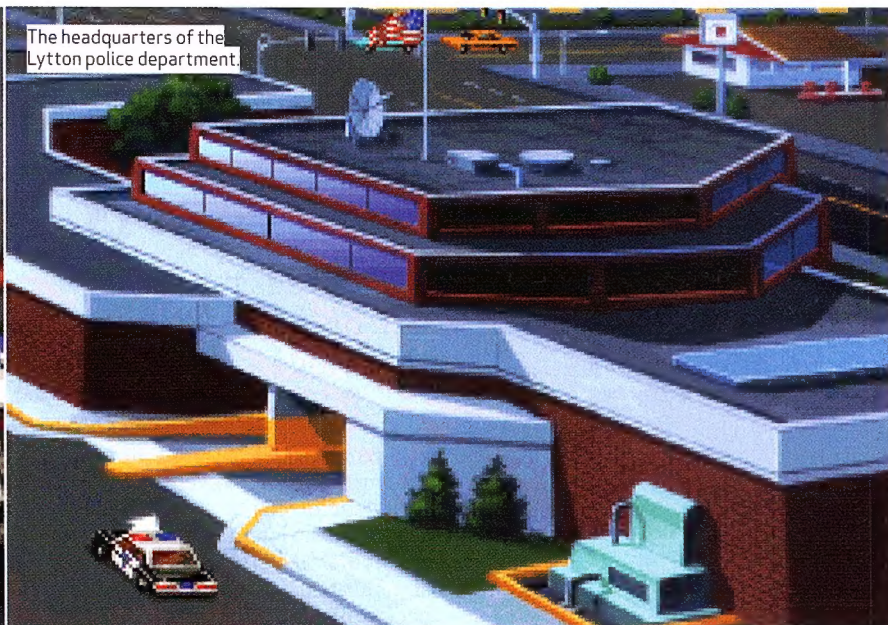
Bonds enters the grimy dive bar, and is approached by one of the gang. "Well, if it ain't Little Boy Blue," mocks the lead biker, who is brandishing a pool cue and doesn't seem like the

pragmatic type. "How'd you like me to help you swallow your tongue? Then you'd really be blue!" So how do you deal with a situation like this? This is one of the most thrilling things about *Police Quest*: Being suddenly confronted with danger, knowing that one bad play could send you to the morgue, and having to safely defuse it. My first, foolish instinct is to pull my .357 Magnum, but I learn the hard way that your service weapon should only ever be used as a last resort.

A series of messages flash up describing the fallout from my decision. Bonds shoots the biker between the eyes, his wife sues the Lytton police department for several million dollars, and Bonds becomes an alcoholic shoe salesman, dying face-down in the gutter. When it comes to admonishing you for making bad decisions, *Police Quest* really doesn't screw around. And so I reload a save from just before I entered the bar and try a different

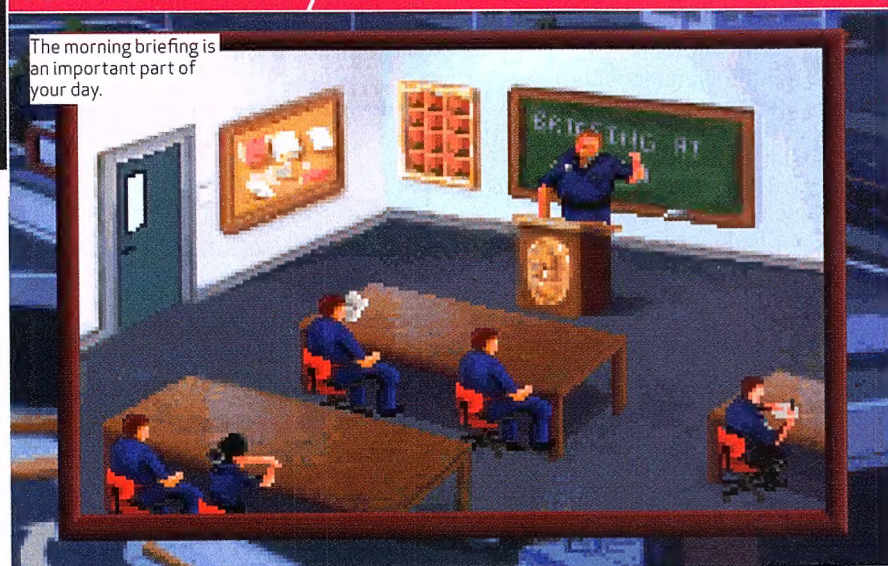


The headquarters of the Lytton police department.



"Police Quest is a fairly standard point-and-click adventure, at least in terms of how you interact with the world."

The morning briefing is an important part of your day.



Make sure you change out of those civvies.



approach, which is a routine you'll get used to when you play this game. Keeping my revolver firmly in its holster, I decide that this time I'm going to try and reason with the hairy biker. Which, I quickly discover, is also a very bad call.

"Your attempt at reason, however noble, has failed," the game tells me after I watch him beat Bonds to a pulp. "It'll take the bar owner months to clean your blood off the walls. This is going to be a closed casket funeral." The consequences of your mistakes are almost comical in their severity, and I often find myself pushing people's buttons, waving my gun around, and generally acting like a jerk to see how the game will punish me. After some more experimenting I discover that the best way to handle the biker is to smack him around with my nightstick. Sensing that I mean business, the gang backs down and agrees to move the bikes. Violence is rarely encouraged in the *Police Quest* series, but sometimes you have no choice.

#### INTERFACE OF OLD

The point-and-click interface is pretty old-fashioned, requiring you to repeatedly right-click to cycle through your various forms of interaction: Look, walk, touch, etc. This was several years before the more intuitive 'verb coin' interface would be developed by LucasArts in games such as *The Curse of Monkey Island* and *Full Throttle*.

But even so, it's still a lot easier to play than the original release's text parser or a *Day of the Tentacle*-style verb wall. And thanks to a release on GOG, along with the rest of the *Police Quest* series, it runs perfectly on a modern PC.

#### THE FINAL INSULT

*Police Quest* is an interesting spin on the adventure genre, eschewing the usual point-and-click puzzles for something more realistic. But each encounter, whether it's pulling a drunk driver over or being the first responder to a shooting, is a puzzle all the same. You have to determine the best and, more importantly, legal way to deal with the situation, and hopefully not get killed in the process. The number of sudden deaths is harsh by modern standards, but it does make me wish adventure games would bring back dying. Often seen as a frustrating relic of the genre's primitive past, the threat of death gives *Police Quest* a genuinely tense feeling of your life being on the line, even if you can just reload your save and try again. ■





## Girl implants Tesla fob into her arm

Never forget your keys again.

A Texan software engineer that goes by the Twitter handle @amiedoubleD has enlisted the help of a biopolymer manufacturer and a 'body modder' called Pineapple to surgically embed a Tesla key fob into her forearm. The small security chip, used to unlock and start her Tesla Model 3, is a flat chip roughly the size of a little finger that was wrangled from one of the car's valet key-cards and inserted into her arm just above her right wrist. Although Amie DD's project was not officially sanctioned by Tesla Inc. she is hoping to get a Tesla service technician to help her pair the fob to her car.



## Storm Area 51 creators launch Alienstock festival

JUST LIKE FYRE BUT WITH ALIENS.

The Storm Area 51 Facebook event that sarcastically encouraged attendees to overrun the infamous US military base garnered enough attention for its Facebook page to be temporarily removed, but this hasn't stopped the event creators from diverting attention to their new alien festival, Alienstock. The four day extraterrestrial celebration event will be held in a less-shooty patch of the Nevada desert called Rachel. It's apparently free, with organisers requesting donations for activities, but this remote town has a population of 52, one fully booked motel called Little A'le-Inn and no gas station, so it's looking like it'll be a massacre on par with the original 'Storm Area 51' plan.



I do not know if this is going to tweet I am talking to my fridge what the heck my Mom confiscated all of my electronics again.

9:43 AM - 8 Aug 2019

14,542 Retweets 64,044 Likes

1.4K 15K 64K

## Girl evades internet ban by Tweeting from the fridge

TEEN TWITTER FEUD GOES ON ICE.

A 15 year old girl known as Dorothy has become instafamous overnight after Tweeting from her LG smart fridge to circumvent an internet ban imposed by her mother. #FreeDorothy managed to accumulate thousands of retweets after her last-ditch effort to connect with the Twittersphere through the fridge was picked up by LG, Twitter and a number of influencers. The saga began with her mother confiscating her smartphone but quickly moved to include a WiiU and Nintendo DS when the account was updated with this notification "I seen [sic] that Dorothy has been using her twitter on her Nintendo."



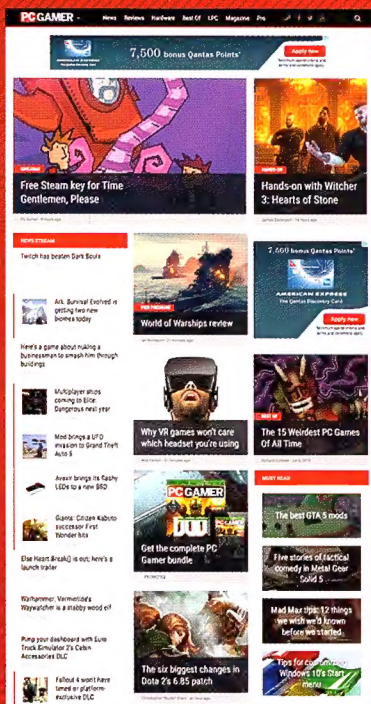
## 'Null' licence plate causes \$12,049 in parking fines

COMICAL NUMBER PLATE ISN'T FUNNY AFTER ALL.

Californian security researcher Joseph Tartaro initially thought it was cool when the DMV approved his request for the plate number 'NULL'. He figured he may even get off the odd parking ticket because the software wouldn't register the classic coding language as a valid number. However this prank backfired pretty severely when Tartaro started getting parking infringement notices he was not responsible for, with many coming from parts of the state he had never been before in his life. At their peak the fines had amassed a total of \$12,049 and the DMV was threatening to not let Tartaro re-register his car until he had paid them. ■



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# 4G LTE CAT4 Routers

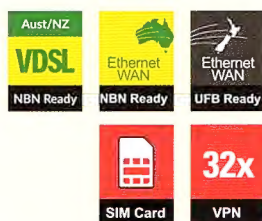
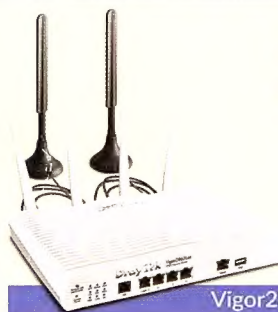
## Mobile Internet Solution for Small-to-Medium Businesses

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**High Speed: up to 150Mbps download and 50Mbps upload**  
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**Great coverage in Australia and New Zealand**

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- Temporary installations such as disaster recovery and emergency situations, exhibitions, sporting events, etc where Internet access is required for a short period.
- Quick setup for remote location or new branches waiting for xDSL/Ethernet WAN (e.g. NBN).
- Multi-WAN series LTE routers (i.e. Vigor2862L, Vigor2926L) support Load Balancing and Failover functions.
- Single WAN series LTE routers support failover functions between xDSL/Ethernet/LTE connections for Vigor2620L, or between Ethernet/LTE connections for VigorLTE 200n.

### Vigor2862L Series



Vigor2862Lac

- 4G LTE Multi-WAN router with SIM card slot
- VDSL2/ADSL2+, Gigabit Ethernet WAN
- SPI Firewall, 802.11ac WLAN
- 16 x VLANs, 32 x VPN tunnels (including 16 x SSL-VPN tunnels)
- Central VPN Management
- Central AP Management
- Support VigorACS 2 (Central Management System) for remote management

### Vigor2926L Series



Vigor2926Lac

- 4G LTE Multi-WAN router with SIM card slot
- 2 x Gigabit Ethernet WAN ports
- SPI Firewall, 802.11ac WLAN
- 16 x VLANs, 50 x VPN tunnels (including 16 x SSL-VPN tunnels)
- Central VPN Management
- Central AP Management
- Support VigorACS 2 (Central Management System) for remote management

### Vigor2620L Series



Vigor2620Ln

- 4G LTE router with dual SIM card slots (SIM slot 2 for failover)
- VDSL2/ADSL2+, Gigabit Ethernet WAN
- SPI Firewall
- 802.11n WLAN
- 2 x VPN tunnels (including 2 x SSL-VPN)
- Central AP Management
- Support VigorACS 2 (Central Management System) for remote management

### VigorLTE 200n



VigorLTE 200n

- 4G LTE router with dual SIM card slots (SIM slot 2 for failover)
- Gigabit Ethernet WAN
- SPI Firewall
- 802.11n WLAN
- 2 x VPN tunnels (including 2 x SSL-VPN)
- Central AP Management
- Support VigorACS 2 (Central Management System) for remote management



i-LAN Technology Pty Ltd trading as DrayTek Aust & NZ  
[www.i-lan.com.au](http://www.i-lan.com.au) (02) 9838 8899 [sales@i-lan.com.au](mailto:sales@i-lan.com.au)  
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